

T H E
MEDICAL WORKS
O F

Dr RICHARD MEAD.

V O L U M E II.

C O N T A I N I N G

A Discourse on the PLAGUE ; A Discourse on the
SMALL-POX and MEASLES ; Rhazes's Treatise
on the SMALL-POX and MEASLES ; An Histo-
rical account of a new method for extracting
the FOUL AIR out of ships, &c. ; and, A Dis-
course on the SCURVY.

E D I N B U R G H.

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MDCCLXV.

MEDICAL WORKS

OF

DR RICHARD MEAD

VOLUME II



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MDCCLXXII

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OF THE PLAGUE
THE
WORKS

OF
Dr RICHARD MEAD.

A DISCOURSE on the PLAGUE.

To the RIGHT HONOURABLE

JAMES CRAIGS, Esq;

One of his Majesty's Principal Secretaries
of State.

S I R,

I Most humbly offer to you my thoughts concerning the prevention of the plague, which I have put together by your command. As soon as you were pleased to signify to me, in his Majesty's absence, that their Excellencies the Lords Justices thought it necessary for the public safety, upon the account of the sickness now in France, that proper directions should be drawn up to defend ourselves from

from such a calamity ; I most readily undertook the task, though upon short warning, and with little leisure : I have therefore rather put down the principal heads of caution, than a set of directions in form.

The first, which relate to the performing quarantines, &c. you, who are perfectly versed in the history of Europe, will see are agreeable to what is practised in other countries, with some new regulations. The next, concerning the suppressing infection here, are very different from the methods taken in former times among us, and from what they commonly do abroad ; but, I persuade myself, will be found agreeable to reason.

I most heartily wish, that the wise measures the government has already taken, and will continue to take, with regard to the former of these, may make the rules about the latter unnecessary. However, it is fit, we should be always provided with proper means of defence against so terrible an enemy.

May this short essay be received as one instance, among many others, of the care you always shew for your country ; and as a testimony of the great esteem and respect, with which I have the honour to be,

S I R,

Your most obedient, and

Most humble servant,

Nov. 25. 1720.

R. MEAD.

P R E-

P R E F A C E.

THis book having at first been written only as a plan of directions for preserving our country from the plague *, was then very short and concise. An act of parliament being immediately after made for performing quarantines, &c. according to the rules here laid down, it passed through seven editions in one year without any alterations. I then thought proper to make some additions to it, in order to shew the reasonableness of the methods prescribed, by giving a more full description of this disease, and collecting some examples of the good success which had attended such measures, when they had been put in practice. At the same time I annexed a short chapter relating to the cure of the plague; being induced thereto by considering how widely most authors have erred in prescribing a heap of useless and very often hurtful medicines, which they recommend under the specious titles of antidotes, specifics, and alexipharmacs: hoping that the great resemblance which I had observed between this disease and the small pox, would justify my writing upon a distemper which I have never seen.

Indeed the small-pox is a true plague, though of a particular kind, bred, as I have shewn all pestilences are, in the same hot Egyptian climate, and brought into Asia and Europe by the way of commerce; but most remarkably by the war with the Saracens, called the holy war, at the latter end of the eleventh and the beginning of the twelfth century. † Ever since which time the morbid seeds

* See the dedication. † Vid. Huet. de rebus ad eum pertinentibus, pag. 23.

of it have been preserved in the infected cloaths and the furniture of houses; and have broken out more or less in all countries, according as the hot and moist temperature of the air has favoured their spreading and the exertion of their force. The measles is likewise a plague *sui generis*, and owes its origin to the same country.

I have now revised my little work once more: and though I cannot find any reason to change my mind as to any material points which regard either the preventing or the stopping the progress of infection; yet I have here and there added some new strokes of reasoning, and, as the painters say, retouched the ornaments, and heightened the colouring of the piece.

The substance of the long preface to the last edition is as follows.

I have insisted more at large upon the infection of this disease, than I could ever have thought needful at this time, after Europe has had experience of the distemper for so many ages: had I not been surprised by the late attempts of some physicians in France to prove the contrary, even while they have the most undeniable arguments against them before their eyes. In particular, I cannot but very much admire to see Dr Chicoyneau, and the other physicians, who first gave us observations on the plague, when at Marseilles, relate, in the reflections they afterwards published upon those observations, the case of a man who was seized with the plague, upon his burying a young woman dead of it, when no one else dared to approach the body; and yet to see them ascribe his disease, not to his being infected by the woman, but solely to his grief for the loss of her, to whom he had

had made love, and to a diarrhœa which had been some time upon him *. No question but these concurred to make his disease the more violent ; and perhaps even exposed him to contract the infection : but why should it be supposed, that he was not infected, I cannot imagine, when there was so plain an appearance of it. I am as much at a loss to find any colour of reason for their denying infection in another case they relate, of a young lady seized with the plague, upon the sudden sight of a pestilential tumour, just broke out upon her maid ; not allowing any thing but the lady's surprise to be the cause of her illness †.

The truth is, these physicians had engaged themselves in an hypothesis, that the plague was bred at Marseilles by a long use of bad aliment, and grew so fond of their opinion, as not to be moved by the most convincing evidence. And thus it mostly happens, when we indulge conjectures instead of pursuing the true course for making discoveries in nature.

I know they imagine this their sentiment to be abundantly confirmed from some experiments made by Dr Deidier ‡ upon the bile taken from persons dead of the plague : which having been either poured into a wound made on purpose in different dogs, or injected into their veins, never failed, in many trials, to produce in them all the symptoms of the pestilence, even the external ones of bubo's and carbuncles. One dog, upon which the experiment succeeded, had been known, for three months before, to devour greedily the corrupted flesh of infected persons, and pledgets

* Observations sur la peste de Marseille, p. 38. 39. 40. † Ibid. p. 113. ‡ Vid. Philos. Trans. N^o 370.

aken off from pestilential ulcers, without receiving any injury. From hence they conclude *, that this disease is not communicated by contagion, but originally bred in the body by the corruption of the bile. This corruption, they say, is the effect of unwholesome food; and the bile thus corrupted, produces a thickness and a degree of coagulation in the blood, which is the cause of the plague: though this they allow to be enforced by a bad season of the year, and the terrors of mind and despair of the inhabitants.

These experiments are indeed curious, but fall very short of what they are brought to prove. The most that can be gathered from them is this: That dogs do not, at least not so readily, receive pestilential infection from men, as men do from one another; and also, that the bile is so highly corrupted in a body infected with the plague, that, by putting it into the blood of a dog, it will immediately breed the same disease.

But it does not follow from hence, that the bile is the seat of the disease, or that other humours of the body are not corrupted as well as this. I make no question but the whole mass of blood is, in this case, in a state of putrefaction; and consequently that all the liquors derived from it partake of the taint.

Accordingly it appeared afterwards from some experiments made by Dr Couzier †, that not only the blood, but even the urine from an infected person, infused into the crural vein of a dog, communicated the plague. I will venture to affirm, that if, instead of bile, blood, or urine, the matter of the ulcers had

* Le journal des sçavans, 1722, p. 279. † Vid. dissertation sur la contagion de la peste. A Toulouse, 1724.
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Pref.

Pref. OF THE PLAGUE.

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been put into a wound made in the dog, it would have had at least an equally pernicious effect; as may well be concluded from the inoculation of the small-pox.

As to the dog's eating the corrupted flesh and purulent matter of the patients; it ought to have been considered that there are some poisons very powerful when mixed immediately with the blood, which will not operate in the stomach at all; as in particular the saliva of the mad dog and the venom of the viper *. And therefore Dr Deidier himself, some months after his former experiments, found that pestiferous bile itself was swallowed by dogs without any harm †.

The right inference to be made from these experiments, I think, would have been this: That since the blood and all the humours are so greatly corrupted in the plague, as that dogs (though not so liable to catch the distemper in the ordinary way of infection, as men are) may receive it by a small quantity of any of these from a diseased subject being mixed with their blood; it may well be supposed, that the effluvia from an infected person, drawn into the body of one who is sound, may be pestiferous and productive of the like disorder.

My assertion, that these French physicians have before them the fullest proofs of this infection, not only appears from these instances of it I have observed to be recorded by themselves; but likewise from what Dr le Moine and Dr Bailly ‡ have written, of the manner in which the plague was brought to Canour-

* Vid. mechanical account of poisons, pag. 31.

† Vid. Philos. Transf. N^o 372.

‡ Vid. lettre de Messieurs le Moine & Bailly.

gue in the Gevaudan : as also from an amazing instance they give us of the great subtilty of this poison, experienced at Marvejols ; where no less than sixty persons were at once infected in a church, by one that came thither out of an infected house. The plague was carried from Marseilles to Canourgue, as follows. A galley-slave, employed in burying the dead at Marseilles, escaped from thence to the village of St Laurent de Rivedolt, a league distant from Corregiac ; where finding a kinsman, who belonged to the latter place, he presented him with a waistcoat and a pair of stockings he had brought along with him. The kinsman returns to his village, and dies in two or three days ; being followed soon after by three children and their mother. His son, who lived at Canourgue, went from thence, in order to bury the family ; and, at his return, gave to his brother-in-law a cloak he had brought with him : the brother-in-law laying it upon his bed, lost a little child which lay with him, in one day's time ; and two days after, his wife ; himself following in seven or eight. The parents of this unhappy family, taking possession of the goods of the deceased, underwent the same fate.

All this abundantly shews how inexcusable the fore-said physicians in France are, in their opposing the common opinion that the plague is contagious. However, I have paid so much regard to them, as to insist the more largely upon the proof of that contagion ; lest the opinion of those who have had so much experience of the disease, might lead any one into an error, in an affair of such consequence, that all my precepts relating to quarantines, and well nigh every particular part of my advice, depends upon it : for
if

if this opinion were a mistake, quarantines, and 'all the like means of defence, ought to be thrown aside as of no use. But as I continue persuaded, that we have the greatest evidence, that the plague is a contagious disease; so I have left, without any alteration, all my directions in respect to quarantines: in which, I hope, I have not recommended any thing prejudicial to trade; my advice being very little different from what has been long practised in all the trading ports of Italy, and in other places. Nay, were we to be more remiss in this than our neighbours, I cannot think but the fear they would have of us, must much obstruct our commerce.

But I shall pursue this point no farther: the rather because a very learned physician among themselves has since, both by strong reasoning and undeniable instances, evinced the reality of contagion*.

In a word, the more I consider this matter, the more I am convinced that the precepts I have delivered, both with regard to the preventing the plague from coming into a country, and the treatment of it when present, are perfectly suitable to the nature of the distemper, and consequently the fittest to be complied with. But how far, in every situation of affairs, it is expedient to grant the powers requisite for putting all of them in practice, it is not my proper business as a physician, to determine. No doubt, but at all times these powers ought to be so limited and restrained, that they may never endanger the rights and liberties of a people. Indeed, as I have had no other view than the public good in this my underta-

* Astruc, dissertation sur la contagion de la peste. A Toulouse, 1724. 8^o.

king, and the satisfaction of doing somewhat towards the relief of mankind, under the greatest of calamities ; so I should not, without the utmost concern, see that any thing of mine gave the least countenance to cruelty and oppression.

But I must confess, I find no reason for any apprehensions of this kind, from any thing I have advanced. For what extraordinary danger can there be, in lodging powers for the proper management of people under the plague, with a council of health, or other magistrates, who shall be accountable, like all other civil officers, for their just behaviour in the execution of them ? Though this I must leave to those who are better skilled in the nature of government. But sure I am, that, by the rules here given, both the sick will be provided for with more humanity, and the country more effectually defended against the progress of the disease, than by any of the methods heretofore generally put in practice, either in our own, or in other nations.

The usage among us, established by act of parliament, of imprisoning in their houses every family the plague seizes on, without allowing any one to pass in or out, but such as are appointed by authority, to perform the necessary offices about the sick, is certainly the severest treatment imaginable ; as it exposes the whole family to suffer by the same disease ; and consequently is little less than assigning them over to the cruellest of deaths ; as I have shewn in the discourse.

The methods practised in France are likewise obnoxious to great objections. Crouding the sick together in hospitals can serve to no good purpose ; but instead

instead thereof will promote and spread the contagion, and besides will expose the sick to the greatest hardships. It is no small part of the misery that attends this terrible enemy of mankind, that whereas moderate calamities open the hearts of men to compassion and tenderness, this greatest of evils is found to have the contrary effect. Whether men of wicked minds, through hopes of impunity, at these times of disorder and confusion, give their evil disposition full scope, which ordinarily is restrained by the fear of punishment; or whether it be, that a constant view of calamities and distress does so pervert the minds of men, as to blot out all sentiments of humanity; or whatever else be the cause: certain it is, that at such times, when it should be expected to see all men unite in one common endeavour, to moderate the public misery; quite otherwise, they grow regardless of each other, and barbarities are often practised, unknown at other times. Accordingly Diemerbroeck informs us, that he himself had often seen these hospitals committed to the charge of villains, whose inhumanity has suffered great numbers to perish by neglect, and that sometimes they have even smothered such as have been very weak, or have had nauseous ulcers difficult to cure. Inasmuch that in many places the sick have chose to lay themselves in fields, in the open air, under the slightest coverings, rather than to fall into the barbarous hands of those who have had the management of these hospitals*.

The rigorous restraints observed at their lines, are attended also with the like inconveniencies. For, by absolutely denying a passage to people from infected

* Diemerbroeck de peste, p. 120.

places, they subject to the same common ruin, both from the disease, and from the disorders committed in such places, those whom their fortunes would otherwise furnish with means of escaping : and this, no doubt, in every free country, must be looked upon as an unjust infringement of liberty, and a diminution of mens natural rights, not to be allowed.

Now, under all these difficulties, I cannot but with the greatest satisfaction observe, that my precepts are well nigh, nay altogether free from them ; and yet a proper regard is had to the disease. As soon as ever the sick are grown numerous, I advise, that they be left in their houses, without any of those unmerciful restraints heretofore put upon them and the families they belonged to. I might, perhaps, have justly directed, that whenever those who frequent or dwell in an infected house, go abroad, they should be obliged to carry about them a long stick of some remarkable colour, or other visible token, by which people may be warned from holding too free converse with them : this being the practice on these occasions, as I have heard, in some places. The removal of the sick from their houses, I advise only at the beginning, when it will be attended with none of the forementioned inconveniencies ; but is what, for the most part, those sick should themselves desire. It has hardly ever been known, when the disease did not first begin among the poor. Such therefore only will be subject to this regulation, whose habitations by the closeness of them are in all respects very incommodious for diseased persons. So that my advice chiefly amounts to the giving relief to the poor, who shall first be infected, by removing them into more convenient lodgings

lodgings than their own, where they shall be better provided for than at home. And the removal of them will not be attended with that danger it is natural for the unskilful to apprehend in so dreadful a disease; because it is every day practised in the small-pox, with great safety. And whereas I have before observed, that people have often suffered in the public hospitals by the inhumanity of their attendants; in this case, little or nothing of that kind is to be feared: for I have proposed this removal of the sick only, at a time, when a long series of calamities has not yet bred disorders and hardness of heart. Nay, it may be reasonably expected that they should rather be used with the tenderest care, when every one shall believe the stopping of the distemper, and consequently their own safety, to depend upon it. And as this treatment will be both safe and beneficial to the sick, so it will be much more evidently for the advantage of the sound part of the family, and of those who live near them. For as the poorer sort of people subsist by their daily labour, no sooner shall the plague have broke out among them, but the sick families, and all their neighbours likewise, if not relieved by the public, shall be abandoned to perish by want, unless the progress of the distemper put a shorter period to their lives.

This observation, that the plague usually begins among the poor, was the reason why I did not make any difference in my directions for removing the sick, in regard to their different fortunes, when I first gave my thoughts upon this subject: which, however, to prevent cavils, I have at present done; and have shewn what method ought to be taken, if, by some unusual chance,

chance, the plague should at the beginning enter a wealthy family. And, in this case, I have advised nothing which I would not most readily submit to myself: for I should much rather chuse to be thus removed from my dwelling, with the distemper upon me to save my family, than they, by being shut up with me, should be all exposed to perish. And as this way of treating diseased families is the most compassionate that can be devised with any regard to the restraining the progress of the distemper; so it is still much preferable to what was formerly practised amongst us on other accounts. For, according to what I have advised, it is only required, to remove some few families at the beginning of the disease: whereas the method of shutting up houses was continued through the whole course of the sickness. Perhaps the plague, under this management, may not reach half a score families: I have given instances where it has thus been stopt in one.

What relates to the inclosing infected places with lines, I have so regulated, that no body can be subjected to any degree of hardship thereby: for I have provided, that free liberty be given to every one that pleases, to depart from the infected place, without being put to any other difficulty, than the performance of a short quarantine of about three weeks, in some place of safety. So that no one shall be compelled to continue in the infected town, whom his own circumstances will not confine.

This part of my directions is not so general as the rest, because some places are too great to admit of it: which occasioned my proposing it with a restriction*.

* In these words, *Where can it be done.*

But

But as this is a great inconvenience to the rest of the country, so it is far from being any advantage to the place thus left unguarded. For when all who leave an infected place, carry with them certificates of their having submitted to such quarantine, as may remove all cause of suspicion, travelling will be much more safe and commodious, than otherwise it can be. For want of this, when the plague was last at London, it was difficult to withdraw from it, while the country was every where afraid of strangers, and the inns on the roads were unsafe to lodge in for those who travelled from the city; when it could not be known, but infection might be received in them by others come from the same place.

And from hence it happened, that the plague, when last in England, though much more moderate, and though it continued not above one year in the city of London, did yet spread itself over a great part of England, getting into Kent, even as far as Dover; into Sussex, Hampshire, Dorsetshire, Essex, Suffolk, Norfolk, Cambridgeshire, Northamptonshire, Warwickshire, Derbyshire, and, to mention no more, as far as Newcastle *.

Thus, as I have examined through the course of the following treatise, with all possible care, into the agreement of my precepts with the nature of the plague; so I have now considered how far they can conveniently be put in practice.

But it is time to have done with a subject by no means agreeable.

I shall therefore conclude all I have to say upon this matter, with a paper well deserving perusal, which

* Vid. the gazettes of the years 1665 and 1666.

is come to my hands, since the following sheets were finished ; and therefore too late to be made use of in its proper place : for which reason I shall give it here entire. This paper contains the methods taken by his late Majesty, when the plague, in the year 1712, had entered his dominions in Germany. It was delivered to me from Mr Backmaister, the secretary at Hanover to his Majesty for the German affairs, who was the person that issued out the orders that were given. This relation I requested from the secretary, being desirous to know how far the measures then taken, agreed with my directions ; because I had been informed, that they were very successful. And I have the satisfaction to find them very conformable to my precepts ; and that they had so much the desired effect, as to stop the plague from spreading beyond the small number of towns and villages recited at the beginning of the paper.

HANOVER, *Feb. 10. N. S. 1722.*

IN 1712 and 1713, the plague raged in these parts, at the following places.

T O W N S.

Lunenburg, Zell, Haarbours, twice.

V I L L A G E S.

Nienfeldt,	Bienenbittel,	Brinckem,
Holdenstedt,	Achem,	Goldenstedt,
Melle,	Trebel,	Fallingbostel.

In the last place, three labouring men, who had made their escape from Hamburg, got into a barn in the night, and were found dead there the next morning.

morning, with marks of the plague upon them : but the progress of the infection was stopt by burning the barn.

As soon as any village was infected, the first thing done was to make a line round it, thereby to hinder the inhabitants from communicating with others. Those who were thus shut up, were immediately furnished with provisions : a physician was sent to them ; and especially some surgeons ; a minister to officiate particularly to persons infected ; a nurse, buriers, &c.

The principal management of this whole affair consisted in two things : 1. In separating the sick from the sound ; and, 2. In cleaning well the houses which had been infected.

When any person was taken ill, he was obliged to leave his lodging, and retire into a lazaretto, or hospital, built for that purpose. The other persons who appeared to be well in the same house, were obliged, when it was practicable, to strip themselves in the night quite naked, to put on other cloaths, which were provided for them, and to go to perform quarantine in a house appointed for it, after having burnt the cloaths they had put off. Persons were made to change their cloaths, and those they put off were burnt, as often as was judged necessary : for example, this was done when those who had recovered their health, came out of the lazaretto and went into quarantine ; and likewise, when (after the disease was ceased) the women who attended the sick, the buriers, and surgeons, went into quarantine.

In summer, ordinary barracks (or huts) were made for those of the common people, who were obliged

to quit infected houses : which barracks were afterwards burnt, when they had been made use of.

As soon as the people were come out of an infected house, it was nailed up, and centinels were posted there, that nothing might be stolen out of it. In the country, when such a house was not of very great value, and it might be done without danger, it was burnt, and the loss was made good to the owner, at the expense of the public. But in towns, where this could not be done, without the hazard of burning the town, men were hired to go into the houses, and bring into the court-yard, or before the house, whatever goods they found in it susceptible of contagion, and there burn them : but to prevent the fright which this might raise among the neighbours, such goods were sometimes put into the cart used to carry off dead bodies, and so conveyed out of the town and burnt. At first the method taken, was only to bury such goods deep in the ground : but it was found by several examples, that they were dug up again, and that the infection was thereby renewed. Before people were paid for their houses and effects that were burnt, it was discovered that they often laid some of their goods out of the way, and that the contagion was spread by them : but after they came to be paid what was reasonable, by the public, they willingly let all be burnt, without concealing any thing.

In summer, the cattle were left abroad, and the inhabitants, who had not the plague in their houses, were obliged to look after them : in winter, the sound persons were obliged, before they left an infected house, to kill the cattle belonging to it, and to bury them

after- them ten feet deep in the ground near the house.
 f. So far the former preface.

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I Think it now proper to take notice, that an act of parliament (as above mentioned in this preface) formed upon the precepts here delivered, having been passed on December 8. 1720, the two last clauses in the said act, relating to the removing of sick persons from their habitations, and the making of lines about places infected, were, on October 19. of the following year, repealed.

This looks as if the rules prescribed were not right and just: I must therefore observe, in justification of myself, that this was not the case. Nothing was urged in that repeal against the reasonableness of the directions in themselves, more than in these words: "That the execution of them might be very grievous to the subjects of this kingdom." But this I have proved to be quite otherwise.

The truth of the matter is this: Some great men, both of the Lords and Commons, who were in the opposition to the court, objected that the ministry were not to be intrusted with such powers, lest they should abuse them; since they might, upon occasion, by their officers, either remove or confine persons not favoured by the government, on pretence that their houses were infected.

Vain and groundless as these fears were, yet the clamours industriously raised from them were so strong, that a great officer in the state thought fit to oblige his enemies by giving way to them: and though a motion made in the house of Commons for repealing these two clauses had just been rejected; yet, upon making

making the same in the house of Lords, with his consent, the thing was done.

Whether private or public considerations had the greater share in bringing about this compliance, I will not determine. Such counter-steps will happen in a government, where there is too much of faction, and too little of a public spirit. This I very well remember, that a learned prelate, now dead, who had more of political than of Christian zeal, and was one who made the loudest noise about the quarantine-bill, frankly owned to me in conversation, that though the directions were good, yet he and his friends had resolved to take that opportunity of shewing their disaffection to the ministry.

But, after all, it contributed not a little to the carrying this point, that the plague was now ceased at Marseilles, and a stop put to its progress in the provinces. And I cannot but take notice, that this last good service was done by the same method, which, though in a more moderate way, I have here proposed. For it is well known, that the regent of France did at last set bounds to the contagion by lines and barriers guarded by soldiers: which wise resolution saved not only his own but other countries from the spreading of a disease, which seems to have been of as violent a kind as ever was brought into Europe.

However, if there were any severity in orders of this kind, every man ought to consider himself as a member of the society; by the laws of which as he receives many advantages, so he gives up somewhat of his own private rights to the public: and must therefore be perfectly satisfied with whatever is found necessary for the common good; although it may,

on particular occasions, bring upon him some inconveniencies and sufferings.

Salus populi suprema lex est.

Does any body complain of ill usage upon his house being ordered to be blown up, to stop the progress of a fire which endangers the whole street; when he reflects that his neighbour, who by this means escapes, must have suffered the same loss for his sake, had it so happened that each had been in the other's habitation?

But in truth, there is no cruelty, but on the contrary real compassion in these regulations, with the limitations I have made: and I am fully persuaded, that whoever with judgment considers the nature of this disease, will easily see that the rules here laid down are not only the best, but indeed the only ones that can effectually answer the purpose. And therefore I should not doubt but that, if this calamity (which God avert!) should be brought into our country, even the voice of the people would cry out for help in this way: notwithstanding wrong notions of their liberties may sometimes over possess their minds, and make them, even under the best of governments, impatient of any restraints.

P A R T I.

OF THE PLAGUE IN GENERAL.

C H A P. I.

Of the origin and nature of the plague.

MY design in this discourse being to propose what measures I think most proper to defend the nation against the plague, and for this end to consider the nature of pestilential contagion as far as is necessary to set forth the reasonableness of the precepts I shall lay down; before I proceed to any particular directions, I shall inquire a little into the causes whence the plague arises, and by what means the infection of it is spread.

In the most ancient times, plagues, like many other diseases, were looked upon as divine judgments sent to punish the wickedness of mankind: and therefore the only defence sought after was by sacrifices and lustrations to appease the anger of incensed heaven*.

How much soever may be said to justify reflections of this kind, since we are assured from sacred history, that divine vengeance has been sometimes executed by plagues; yet it is certain, that such speculations pushed too far, were then attended with ill consequences, by obstructing inquiries into natural causes, and encouraging a supine submission to those e-

* Celsus de medic. in præfat. Morbos ad iram deorum immortalium relatos esse, et ab iisdem opem posci solitam.

vils; against which the infinitely good and wise author of nature has in most cases provided proper remedies.

Upon this account, in after-ages, when the profession of physic came to be founded upon the knowledge of nature, Hippocrates strenuously opposed this opinion, that some particular sicknesses were divine, or sent immediately from the gods; and affirmed, that no diseases came more from the gods than others, all coming from them, and yet all owning their proper natural causes: that the sun, cold, and winds were divine; the changes of which, and their influences on human bodies, were diligently to be considered by a physician *.

Which general position this great author of physic intended to be understood with respect to plagues as well as other distempers: how far he had reason herein, will in some measure appear, when we come to search into the causes of this disease.

But in order to this inquiry, it will be convenient, in the first place, to remove an erroneous opinion some have entertained, that the plague differs not from a common fever in any thing besides its greater violence. Whereas it is very evident, that since the small-pox and measles are allowed to be distempers distinct in specie from all others, on account of certain symptoms peculiar to them; so, for the same reason, it ought to be granted, that the plague no less differs in kind from ordinary fevers: for there are a set of distinguishing symptoms as essential to the pestilence, as the respective eruptions are to the small-pox or measles; which are indeed (as I have men-

* Libr. de morbo sacro; et libr. de aëre, locis, et aquis.
tioned.

tioned in the preface) each of them plagues of a particular kind.

As the small-pox discharges itself by pustules raised in the skin; so in the plague the noxious humour is thrown out either by tumours in the glands, as by a parotis, bubo, and the like; or by carbuncles thrust out upon any part of the body. And these eruptions are so specific marks of this distemper, that one or other of them is never absent: unless through the extreme malignity of the disease, or weakness of nature, the patient sinks, before there is time for any discharge to be made this way; that matter, which should otherwise have been cast out by external tumours, seizing the viscera, and producing mortifications in them.

Sometimes indeed it happens, by this means, that these tumours in the glands, and carbuncles, do not appear; just as a bad kind of the small-pox in tender constitutions sometimes proves fatal before the eruption, by a diarrhœa, hæmorrhage, or some such effect of a prevailing malignity.

The French physicians having distinguished the sick at Marseilles into five classes, according to the degrees of the distemper, observed bubo's and carbuncles in all of them, except in those of the first class, who were so terribly seized, that they died in a few hours, or at farthest in a day or two, sinking under the oppression, anxiety, and faintness, into which they were thrown by the first stroke of the disease; having mortifications immediately produced in some of the viscera, as appeared upon the dissection of their bodies *.

* Observat. et reflex. touchant la nature, &c. de la peste de Marseilles, pag. 47. et suiv.

And

And this observation of the French physicians, which agrees with what other authors have remarked in former plagues, fully proves, that these eruptions are so far from being caused solely by the greater violence of this disease, than of other fevers, that they are only absent, when the distemper is extraordinary fierce ; but otherwise they constantly attend it, even when it has proved so mild, that the first notice the patient has had of his infection, has been the appearance of such a tumour ; as, besides these French physicians, other authors of the best credit have assured us. From whence we must conclude, that these eruptions are no less a specific mark of this disease, than those are by which the small-pox and measles are known and distinguished. And as in the first class of those attacked with the plague, so likewise in these two distempers we often find the patient to die by the violence of the fever, before any eruption of the pustules can be made.

This circumstance of the plague being mortal before any eruptions appeared, was attended with a great misfortune. The physicians and surgeons appointed to examine the dead bodies, finding none of the distinguishing marks of the disease, reported to the magistrates that it was not the plague ; and persisted in their opinion, till one of them suffered for his ignorance, and himself, with part of his family, died by the infection : this assurance having prevented the necessary precautions *.

And this in particular shews us the difference between the true plague, and those fevers of extraordinary malignity, which are the usual forerunners of it,

* Journal de la contagion à Marseille, p. 6.

and are the natural consequence of that ill state of air we shall hereafter prove to attend all plagues. For since all those fevers from which people recover without any discharge by tumours in the glands, or by carbuncles, want the characteristic signs, which have been shewn to attend the slightest cases of the true plague; we cannot, upon any just ground, certainly conclude them to be a less degree only of that distemper: but, as far as appears, they are of a different nature, are not ordinarily contagious like the plague, nor yet have any such necessary relation to it, but that such fevers do sometimes appear, without being followed by a real pestilence.

On the other hand, I would not be understood to call every fever a plague, which is followed by eruptions resembling those here mentioned: for as every boil or pustule which breaks out upon the skin, is not an indication of the small-pox, nor every swelling in the groin a venereal bubo; so there are carbuncles not pestilential, and other fevers, besides the plague, which have their crisis by tumours and abscesses, and that sometimes even in the parotid or other glands. There is indeed usually some difference between these swellings in the plague, and in other fevers, especially in the time of their coming out: for in the plague they discover themselves sooner than in most other cases. But the principal difference between these diseases is, that the plague is infectious, the other not; at least not to any considerable degree.

And this leads me to another character of this disease, whereby it is distinguished from ordinary fevers, which is the contagion accompanying it. This is a very ancient observation. - Thucydides makes it a part

of

of his description of the plague at Athens *; and Lucretius, who has almost translated this description of Thucydides, dwells much upon it †. Aristotle makes it one of his problems ‡, how the plague in-

* Lib. 2. "Οτι ἑτέρῳ ἀφ' ἑτέρου, θεραπείας ἀναπιμπλάμενοι· ὥσπερ τὰ πρόβατα ἐθησκον· ἢ τὴν πλείστον φθόρον τῷτο ἐνποιεῖ· ἔτε γὰρ μὴ θέλοιν διδόντες ἀλλήλοις προσίεναι, ἀπάλλυντο ἑήμοι, ἢ οἰκίαι πολλαὶ ἐκενώθησαν ἀπορία τῇ θεραπείᾳ· ἔτε προσίοιεν, διεφθείροντο, καὶ μάλιστα οἱ ἀρετῆς τι μεταποιούμενοι. The begining of this passage, as it here stands, though it is found thus in all the editions of Thucydides, is certainly faulty, *θεραπείας ἀναπιμπλάμενοι* being no good sense. The sentence I shall presently cite from Aristotle shews that this may be rectified only by removing the comma after *ἑτέρῳ*, and placing it after *θεραπείας*; for *προσ-αναπιμπλήμι* in Aristotle absolutely used signifies to infect. With this correction, the sense of the place will be as follows. The people took infection by their attendance on each other, dying like flocks of sheep. And this effect of the disease was the principal cause of the great mortality: for either the sick were left destitute, their friends fearing to approach them, by which means multitudes of families perished without assistance; or they infected those who relieved them, and especially such whom a sense of virtue and honour obliged most to their duty.

The sense here ascribed to the word *ἀναπιμπλήμι*, is confirmed yet more fully by a passage in Livy, where he describes the infection attending a plague or camp-fever, which infested the armies of the Carthaginians and Romans at the siege of Syracuse, in such words, as shew him to have had this passage of Thucydides in view; for he says, *aut neglecti desertique, qui incidissent, morerentur; aut assidentes curantesque eadem vi morbi repletos secum traherent.* Lib. xxv. c. 26.

† Lib. vi. ver. 1234.

— *nullo cessabant tempore apisci*

Ex aliis alios avidi contagia morbi.

Et ver. 1241.

Qui fuerant autem præsto, contagibus ibant.

‡ Sect. 1. Διὰ τί ποτε ὁ λοιμὸς μόνη τῶν νόσων μάλιστα τῆς πλησιάζοντος τοῖς θεραπευομένοις προσαναπιμπλήσῃ;

fects

fects those who approach to the sick. And what is of more consequence, Galen himself is very clear in it *; for he has these words : ὅτι συνδιατρέχειν τοῖς λοιμώτευσιν ἐπισφαλές, ἀπολαῦσαι γὰρ κίνδυνος, ὥσπερ ψάρας τινός, &c. that it is unsafe to be about those who have the plague, for fear of catching it, as in the itch, &c. Indeed this is a thing so evident, that we find it at present the current opinion of all mankind, a very few persons only excepted, who have distinguished themselves by their singularity in maintaining the opposite sentiment. And it is something strange that any one should make a question of a thing so obvious, which is proved sufficiently by one property only of the disease, that whenever it seizes one person in a house, it immediately after attacks the greatest part of the family. This effect of the plague has been so remarkable at all times, that whoever considers it well, cannot possibly, I think, have any doubt remaining, or require any stronger argument to convince him, that the disease is infectious. For this very reason the small-pox and measles are generally allowed to be contagious; because it is observed, that when either of these diseases is got among a family, it usually seizes successively the greatest part of that family, who have not had it before; at least, if such in the family hold free communication with the sick. And by the same argument the plague must be concluded to be infectious likewise. It cannot be pretended, that this is occasioned in the plague from this only, that the sound persons are rendered more than ordinarily obnoxious to the unhealthy air, or whatever be the common cause of the disease, by being put into

* Περὶ διαφορᾶς πυρετῶν, βιβ. α.

fear and dispirited, upon seeing others in the same house taken sick : for if this were the case, children, who are too young to have any apprehensions upon this account, would escape better than others, the contrary of which has been always experienced.

It is true, some have not been attacked by the disease, though constantly attending about the sick. But this is no objection against what is here advanced : for it is as easily understood how some persons, by a particular advantage of constitution, should resist infection, as how they should constantly breathe a noxious air without hurt. An odd observation of Diemerbroeck deserves notice in this place : That part of a family removed into a town free from the plague, was observed by him to be taken ill of it soon after the part left behind in the diseased town fell sick : which certainly would scarce have happened, unless a communication between the healthy and the sick, by letters or otherwise, was capable of causing it *. Of the same nature is a circumstance recorded by Evagrius of the plague, which he describes, and what, he owns, surprised him very much : that many of those who left infected places, were seized with the plague in the towns to which they had retired, while the old inhabitants of those towns were free from the disease †. But to multiply proofs of a thing so evident is needless ; innumerable are at hand, and several will occasionally occur in the following parts of this discourse, when we come to speak in particular of the ways by which this infection is conveyed about. I shall therefore say no more in this place, but only, that all the appear-

* De peste, c. 4. annot. 6. † Evagrii histor. eccles. lib. iv. c. 29.

ances attending this disease are very easily explained upon this principle, and are hardly to be accounted for upon any other. We learn from hence the reason why when the plague makes its first appearance in any place, though the number of sick is exceeding small, yet the disease usually operates upon them in the most violent manner, and is attended with its very worst symptoms. Now, was the disease produced not by imported contagion, but from some cause, which had its original in the diseased place, and consequently from a cause gradually bred, the contrary must happen: the diseased would at first not only be few in number, but their sickness likewise more moderate than afterwards, when the morbidic causes were raised to their greatest malignity. From the same principle we see the reason, why people have often remained in safety in a diseased town, only by shutting themselves up from all communication with such as might be suspected of giving them the disease. When the plague was last in England, while it was in the town of Cambridge, the colleges remained entirely free by using this precaution. In the plague at Rome, in the years 1656 and 1657, the monasteries and nunneries, for the most part, defended themselves by the same means *: whereas at Naples, where the plague was a little before, these religious houses, from their neglect herein, did not escape so well †. Nay the infection entered none of the prisons at Rome ‡, though the nastiness of those places exposes them very much. But, to avoid prolixity, I shall give only one instance more. I think it cannot be explained in a

* Gastaldi de avertenda et profliganda peste, p. 117.

† Ibid. p. 118.

‡ Ibid. p. 117.

ny other reasonable manner, how the last plague in the city of London, which broke out in the parish of St Giles's in the fields towards the latter end of the year 1664, should lie asleep from Christmas to the middle of February, and then break out again in the same parish; and after another long rest till April, shew itself again in the same place *.

To proceed: Whoever examines the histories of plagues in all times, which have been described with any exactness, will find very few that do not agree in these essential marks, whereby the plague may be distinguished from other fevers. I confess an instance or two may be found to the contrary: perhaps the history of our own country furnishes the most remarkable of any †. But examples of this kind are so very rare, that I think it must be concluded, that the plague is usually one and the same distemper.

In the next place, I shall endeavour to shew, that the plague has always the same original, and is brought from Africa, the country which has entailed upon us two other infectious distempers, the small-pox and measles. In all countries indeed epidemic diseases extraordinarily mortal, are frequently bred in jails, sieges, camps, &c. which authors have often in a large sense called pestilential: but the true plague, which is attended with the distinguishing symptoms before described, and which spreads from country to country, I take to be an African fever bred in Æthiopia or Egypt, and the infection of it carried by trade into the other parts of the world.

It is the observation of Pliny, that the pestilence

* See bills of mortality for the year 1665.

† The sweating sickness.

always travels from the southern parts of the world to the western, that is, in his phrase, into Europe *. And the most accurate accounts in all times of this disease, where-ever it has raged, bring it from Africa. Thucydides †, in his admirable description of the famous plague of Athens, says, that it began in Upper Æthiopia, then came into Egypt, from whence it was spread first into Persia, and afterwards into Greece.

There is in all ancient history no account of any plague so dreadful as that which broke out at Constantinople in the time of the Emperour Justinian, A. D. 543: This is said to have spread its infection over all the earth, and to have lasted fifty-two years. The history of it is very well told by Evagrius ‡, and yet more learnedly by Procopius §: and they both observe, that the distemper had its birth in Æthiopia or Egypt.

This is likewise agreeable to the modern relations of travellers and merchants from Turkey, who generally inform us, that the frequent plagues which depopulate that country, are brought thither from the coast of Africa; insomuch that at Smyrna, and other ports of that coast, they often know the very ship which brings it. And, in these latter ages, since our trade with Turkey has been pretty constant, the plagues in these parts of Europe have evidently been brought from thence.

The late plague in France came indisputably from Turkey, as I shall particularly shew in some of the following pages. The plague which broke out at

* Nat. hist. lib. vii. c. 50. † Histor. lib. ii. ‡ Hist. ecclesiast. lib. iv. c. 29. § De bello Persico, lib. ii. c. 22.

Dantzic in the year 1709, and spread from thence to Hamburg, Copenhagen, and other cities in the north, made its way thither from Constantinople through Poland, &c. And the last plague in this city, if we may believe Dr Hodges, had the same original, being brought to us from Holland, but carried to them by cotton imported from Turkey *.

The greatest mortality that has happened in latter ages, was about the middle of the fourteenth century, when the plague seized country after country for five years together †. In the year 1346 it raged in Egypt, Turkey, Greece, Syria, and the East Indies; in 1347 some ships from the Levant carried it to Sicily, Pisa, Genoa, &c. in 1348 it got into Savoy, Provence, Dauphiny, Catalonia, and Castile, &c. in 1349 it seized England, Scotland, Ireland, and Flanders; and the next year Germany, Hungary, and Denmark: and in all places where it came, it made such heavy destruction, that it is said to have dispeopled the earth of more than half its inhabitants ‡. Now, since Africa had a share of this plague in the very beginning, I question not but it had its first rise in that country; and not in China, as M. Villanni, in his history of those times, relates from the report of Genoese seamen, who came from those parts, and said it was occasioned there by a great ball of fire, which either burst out of the earth, or fell down from heaven ||. But this relation is so very incredible, that I cannot think we ought at all to rely upon it: see-

* Vid. Hodges de peste.
Villanni, l. i. c. 2.
m. i. p. 798.

† Vid. istorie di Matteo
‡ Mezeray hist. de France,
|| Villanni, loco citato.

ing we have no instance of a plague, which was originally bred in that country.

It is very remarkable, that the several countries of Europe have always suffered more or less in this way, according as they had a greater or lesser commerce with Africa, or with those parts of the east that have traded thither. Which observation, by the by, may help to solve a difficulty concerning the great increase of people among the northern nations in ancient times, more than at present; for in those ages, having no communication at all with Africa, they were not wasted with plagues, as they have been since.

As the people of Marseilles, from the first foundation of their city by the Phoceans, were famous for trade, and made long voyages southwards on the African coast *; so they have in all times been very liable to the plague. A French author †, in a history of the late plague at Marseilles, reckons up twenty plagues that have happened in that city; notwithstanding it is by its situation one of the most healthy and pleasant places in France, and the least subject to epidemic distempers. But if we had no records of this in history, an odd custom among them, mentioned in antiquity ‡, of the way they made use of to clear themselves from this distemper, would be a proof of it. Their manner at such times was, that some one poor man offered himself to be maintained at the public expence with delicate food for a whole

* Vid. Huet. *histoire du commerce des anciens*, p. 88.

† Relation historique de tout ce qui s'est passé à Marseille pendant la dernière peste. ‡ Vid. Serv. comment. in Virgil. *Æneid.* lib. iii. ver. 57.

year : at the end of which he was led about the city dressed in consecrated garments and herbs ; and being loaded with curses as he went along, that the evils of the citizens might fall upon him, he was at last thrown into the sea *.

Agreeable to this remark upon trade is the observation of Procopius in his forecited history, that the plague was always found to spread from maritime places into the inland countries : which has ever since been confirmed by experience.

Having shewn this disease to be a distemper of a distinct species, and to take its rise only in Africa ; we must next seek for its cause in that country, and no where else. We ought therefore to consider, what there is peculiar to that country, which can reasonably be supposed capable of producing it. Wherefore I shall briefly set down as much as serves for this purpose of the state of Grand Cairo in Egypt; and of Æthiopia, the two great seminaries of the plague ;

* This was a kind of expiatory sacrifice, as the scape-goat among the Jews, Lev. xvi. And the wretches thus devoted to die for the sins of the people were called *καθάρματα*, purgations. Vid. Aristophan. in Plut. ver. 454. & in Equit. ver. 1133. & Scholiast. ib. Suidas adds, that when the sacrificed person was cast into the water, these words were pronounced, *Περίψημα ἡμῶν γενῆ*, Be thou our cleansing. And I observe, by the by, that the apostle Paul, 1 Cor. iv. 13. alluding very probably to this wicked custom, makes use of both these words, where speaking of himself in the plural number, he says, *ὡς περικαθάρματα τῷ κόσμῳ ἐγενήθημεν, πάντων περίψημα* ; for some of the best MSS. instead of *ὡς περικαθάρματα*, read *ὡς περὶ*, or *ὡς περὶ καθάρματα* ; that is, We have been looked upon as wretches fit only to be sacrificed for the public good, and cast out of the world by way of atonement for the sins of the whole society.

travellers

travellers relating that these countries are more infested with it than most other parts of Africa.

Grand Cairo is crouded with vast numbers of inhabitants, who for the most part live very poorly and nastily; the streets are very narrow, and close: it is situate in a sandy plain at the foot of a mountain, which by keeping off the winds, that would refresh the air, makes the heats very stifling. Through the midst of it passes a great canal, which is filled with water at the overflowing of the Nile; and after the river is decreased, is gradually dried up: into this the people throw all manner of filth, carrion, &c. so that the stench which arises from this, and the mud together, is insufferably offensive *. In this posture of things, the plague every year constantly preys upon the inhabitants; and is only stopt, when the Nile, by overflowing, washes away this load of filth; the cold winds, which set in at the same time, lending their assistance, by purifying the air.

In Æthiopia, those prodigious swarms of locusts, which at some times cause a famine, by devouring the fruits of the earth, unless they happen to be carried by the winds clear off into the sea, are observed to entail a new mischief upon the country, when they die and rot, by raising a pestilence †; the putrefaction being heightened by the excessive intemperance of the climate, which is so very great in this country, that it is infested with violent rains at one season of the year, for three or four months together ‡. And it is par-

* Vid. le Brun voyage au Levant, c. xxxviii.

† Vid. Ludolf. histor. Æthiop. lib. i. c. 13. & D. August. de civitat. Dei, lib. iii. c. ult.

‡ Vid. Ludolf. histor. Æthiop. lib. i. c. 5. & comment.

ticularly observed of this country, that the plague usually invades it, whenever rains fall during the sultry heats of July and August *, that is, as Lucretius expresses it, when the earth is

Intempestivis pluviisque et solibus ieta †.

Now, if we compare this last remark of the intemperance of the climate in Æthiopia, with what the Arabian physicians ‡, who lived near these countries, declare, that pestilences are brought by unseasonable moistures, heats, and want of winds ; I believe we shall be fully instructed in the usual cause of this disease. Which, from all these observations compared together, I conclude to arise from the putrefaction so constantly generated in these countries, when that is heightened and increased by the ill state of air now described ; and especially from the putrefaction of animal substances.

It is very plain, that animal bodies are capable of being altered into a matter fit to breed this disease : because this is the case of every one who is sick of it, the humours in him being corrupted into a substance which will infect others. And it is not improbable, that the volatile parts with which animals abound, may in some ill states of air in the sultry heats of Africa be converted by putrefaction into a substance of the same kind : since, in these colder regions, we sometimes find them to contract a greater degree of acrimony than most other substances will do by putrefying, and also more dangerous for men to come within the reach of their action ; as in those pernicious,

* J. Leo hist. Afric. lib. i. † Lib. vi. ver. 1100.

‡ Rhaf. et. Avicen.

cious, and even poisonous juices, which are sometimes generated in corrupted carcases: of which I have formerly given one very remarkable instance *, and, if it were necessary, many more might be produced, especially in hydropic bodies, and in cancerous tumours. Nay more, we find animal putrefaction sometimes to produce in these northern climates very fatal distempers, though they do not arise to the malignity of the true plague: for such fevers are often bred, where a large number of people are closely confined together; as in gaols, sieges, and camps.

And perhaps it may not be here amiss to remark, that the Egyptians of old were so sensible how much the putridness of dead animals contributed towards breeding the plague, that they worshipped the bird Ibis for the service it did in devouring great numbers of serpents; which they observed did hurt by their stench when dead, as well as by their bite when alive †.

But no kind of putrefaction is ever heightened in these European countries to a degree capable of producing the true plague: and we learn from the observation of the Arabian physicians, that some indispotion of the air is necessary in the hottest climates, either to cause so exalted a corruption of the forementioned substances, or at least to enforce upon mens bodies the action of the effluvia exhaled from those substances, while they putrefy. Both which effects may well be expected from the sensible ill qua-

* Essay on poisons. † Cicero de nat. Deor. lib. i. § 36. speaking of these birds, says: *Avertunt pestem ab Ægypto, cum volucres angues ex vastitate Libyæ vento Africo invecas interficiunt atque consumunt; ex quo fit ut illæ nec morsu vivæ noceant, nec odore mortuæ.*

lities of the air before described, whenever they continue and exert their force together any considerable time.

What I have here advanced of the first original of the plague, appears to me so reasonable, that I cannot enough wonder at authors for quitting the consideration of such manifest causes for hidden qualities; such as malignant influences of the heavens; arsenical, bituminous, or other mineral effluvia, with the like imaginary or uncertain agents.

This however I do not say with design absolutely to exclude all disorders in the air, that are more latent than the intemperate heat and moisture before mentioned, from a share in increasing and promoting the infection of the plague, where it is once bred: for I rather think this must sometimes be the case; like to what is observed among us in relation to another infectious distemper, namely, the small-pox, which is most commonly spread and propagated by the same manifest qualities of the air as those here described: notwithstanding which, this distemper is sometimes known to rage with great violence in the very opposite constitution of air, *viz.* in the winter during dry and frosty weather. But to breed a distemper, and to give force to it when bred, are two different things. And though we should allow any such secret change in the air to assist in the first production of the disease; yet it may justly be censured in these writers, that they should undertake to determine the specific nature of these secret changes and alterations, which we have no means at all of discovering: since they do not shew themselves in any such sensible manner, as to come directly under our examination;

examination; nor yet do their effects, in producing the plague, point out any thing of their specific nature.

All that we know is this, that the cause of the plague, whatever it be, is of such a nature, that when taken into the body, it works such changes in the blood and juices, as to produce this disease, by suddenly giving some parts of the humours such corrosive qualities, that they either excite inward inflammations and gangrenes, or push out carbuncles and bubo's; the matter of which, when suppurated, communicates the like disease to others: but of the manner how this is done, I shall discourse in the following chapter.

C H A P. II.

Of the causes which spread the plague.

I Have been thus particular in tracing the plague up to its first origin, in order to remove, as much as possible, all objections against what I shall say of the causes which excite and propagate it among us. This is done by contagion. Those who are strangers to the full power of this, that is, those who do not understand how subtle it is, and how widely the distemper may be spread by infection, ascribe the rise of it wholly to the malignant quality of the air in all places, where-ever it happens; and, on the other hand, some have thought that the consideration of the infectious nature of the disease must exclude all regard to the influence of the air: whereas the contagion accompanying the disease, and the disposition

position of the air to promote that contagion, ought equally to be considered; both being necessary to give the distemper full force. The design therefore of this chapter is to make a proper balance between these two, and to set just limits to the effects of each.

For this purpose, I shall reduce the causes which spread the plague, to three; diseased persons, goods transported from infected places, and a corrupted state of air.

There are several diseases which will be communicated from the sick to others; and this not done after the same manner in all. The hydrophobia is communicated no other way than by mixing the morbid juices of the diseased animal immediately with the blood of the sound, by a bite, or what is analogous thereto; the itch is given by simple contact; the lues venerea not without a closer contact; but the measles, small-pox, and plague, are caught by a near approach only to the sick: for in these three last diseases persons are rendered **obnoxious** to them only by residing in the same house, and conversing with the sick.

Now, it appears by the experiments mentioned in the preface, of giving the plague to dogs by putting the bile, blood, or urine from infected persons, into their veins, that the whole mass of the animal fluids in this disease is highly corrupted and putrefied. It is therefore easy to conceive how the **effluvia** or fumes from liquors so affected may taint the ambient air. And this will more especially happen, when the humours are in the greatest fermentation, that is, at the height of the fever: as it is observed that fermenting liquors do at the latter end of their intestine motion throw off a great quantity of their most **subtile**

and active particles. And this discharge will be chiefly made upon those glands of the body, in which the secretions are the most copious, and the most easily increased: such are those of the mouth and skin. From these therefore the air will be impregnated with pestiferous atoms: which being taken into the body of a sound person will, in the nature of a ferment, put the fluids there into the like agitation and disorder.

The body, I suppose, receives them these two ways, by the breath, and by the skin; but chiefly by the former.

I think it certain that respiration does always communicate to the blood some parts from the air: which is proved from this observation, that the same quantity of air will not suffice long for breathing, though it be deprived of none of those qualities, by which it is fitted to inflate the lungs and agitate the blood, the uses commonly ascribed to it. And this is farther confirmed by what the learned Dr Halley has informed me, that when he was several fathom under water in his diving-engine, and breathing an air much more condensed than the natural, he observed himself to breathe more slowly than usual: which makes it more than probable, that this conveying to the blood some subtile parts from the air, is the chief use of respiration: since when a greater quantity of air than usual was taken in at a time, and consequently more of these subtile parts received at once by the blood, a less frequent respiration sufficed.

As to the skin, since there is a continual discharge made through its innumerable pores, of the matter of insensible perspiration and sweat; it is very possible that the same passages may admit subtile corpuscles,

which

which may penetrate into the inward parts. Nay, it is very plain that they do so, from what we observe upon the outward application of ointments and warm bathings; which have their effects by their finest and most active parts insinuating themselves into the blood.

It is commonly thought, that the blood only is affected in these cases by the morbid effluvia. But I am of opinion, that there is another fluid in the body, which is, especially in the beginning, equally, if not more, concerned in this affair: I mean the liquid of the nerves, usually called the animal spirits. As this is the immediate instrument of all motion and sensation, and has a great agency in all the glandular secretions, and in the circulation of the blood itself; any considerable alteration made in it must be attended with dangerous consequences. It is not possible that the whole mass of blood should be corrupted in so short a time as that in which the fatal symptoms, in some cases, discover themselves. Those patients of the first class, mentioned in the beginning of this discourse, particularly the porters who opened the infected bales of goods in the lazaretto's of Marseilles, died upon the first appearance of infection, as it were by a sudden stroke; being seized with rigours, tremblings, heart-sickness, vomitings, giddiness and heaviness of the head, an universal languor and inquietude; the pulse low and unequal: and death ensued sometimes in a few hours.

Effects so sudden must be owing to the action of some corpuscles of great force insinuated into, and changing the properties of, another subtile and active fluid.

fluid in the body ; and such an one, no doubt, is the nervous liquor.

It is not to be expected that we should be able to explain the particular manner by which this is brought about. We know too little of the frame of the universe, and of the laws of attractions, repulsions, and cohesions among the minutest parcels of matter, to be able to determine all the ways by which they affect one another, especially within animal bodies, the most delicate and complicated of all the known works of nature. But we may perhaps make a probable conjecture upon the matter. Our great philosopher, whose surprising discoveries have exceeded the utmost expectations of the most penetrating minds, has demonstrated that there is diffused through the universe a subtile and elastic fluid of great force and activity. This he supposes to be the cause of the refraction and reflection of the rays of light ; and that by its vibrations light communicates heat to bodies ; and, moreover, that this readily pervading all bodies, produces many of their effects upon one another *.

Now, it is not improbable that the animal spirits are a thin liquor, separated in the brain, and from thence derived into the nerves, of such a nature that it admits, and has incorporated with it, a great quantity of this elastic fluid ; which makes it a vital substance of great energy. And a liquor of this kind must be very susceptible of alterations from other active bodies of a different nature from it, if they approach to and are mixed with it : as we see some chemical spirits upon their being put together, fall in-

* Newton's optics, qu. 18. to 24.

to a fermentation, and make a composition of a quite different kind.

If therefore we allow the effluvia or exhalations from a corrupted mass of humours in a body that has the plague to be volatile and fiery particles, carrying with them the qualities of those fermenting juices from which they proceed; it will not be hard to conceive how these may, when received into the nervous fluid of a sound person, excite in it such intestine motions as may make it to partake of their own properties, and become more unfit for the purposes of the animal oeconomy. But of this more in another place.

This is one means by which the plague, when once bred, is spread and increased: but the second of the forementioned causes, namely, goods from infected places, extends the mischief much wider. By the preceding cause, the plague may be spread from person to person, from house to house, or perhaps from town to town, though not to any great distance; but this carries it into the remotest regions. From hence the trading parts of Europe have their principal apprehensions, and universally have recourse to quarantines for their security. The universality of which practice is a strong argument, that merchandise will communicate infection: for one cannot imagine, that so many countries should agree in such a custom without the most weighty reasons. But besides, there is not wanting express proof of this, from particular examples, where this injury has been done by several sorts of goods carried from infected places to others. Some of these I shall hereafter be obliged to mention; at present I shall confine myself to three instances only. The first shall be

of the entrance of the plague into Rome in the year 1656, which we are assured was conveyed thither from Naples by cloths and other wares from that place, brought first to Port Neptuno, and carried from thence to the neighbouring castle of St Lawrence : which, after having been kept some time there, were conveyed into Rome *. The second instance I shall take is from the account given us of the entrance of the plague into Marseilles † ; which being drawn up with great exactness, may be the more relied on. It appears indisputably by this account, that the mischief was brought thither by goods from the Levant. For the first who had the distemper, was one of the crew of the ship which brought those goods : the next were those who attended upon the same goods, while they were under quarantine ; and soon after the surgeon, whom the magistrates of Marseilles appointed to examine the bodies of those who died.

This relation, if duly considered, is, I believe, sufficient to remove all the doubts any one can have about the power of merchandise to convey infection : for it affords all the evidence the most scrupulous can reasonably desire. Possibly there might be some fever of extraordinary malignity in Marseilles, such as is commonly called pestilential, before the arrival of these goods : but no such fever has any indisputable right to the title of pestilence, as I have before shewn. On the contrary, these two, the real pestilence, and such pestilential fevers, must carefully be distinguished, if we design to avoid all mistakes in reasoning upon these subjects.

* Gastaldi de peste, p. 116.
s'est passé à Marseilles, &c.

† Journal de ce qui

Some such fever of uncommon malignity, I say, might perhaps be in Marseilles before the arrival of these goods. There might likewise perhaps be an instance or two of fevers attended with eruptions, bearing some resemblance to those of the plague: for such I myself have sometimes seen here in London. But it is not conceivable, that there should be any appearance of the true plague before that time: for it was full six weeks from the time of the sailor's death, which had given the alarm, and raised a general attention, before the magistrates received information of any one's dying of the plague in the city. And I believe it was never known, that the plague being once broke out, gave so long a truce in hot weather.

The plague which has this present year almost depopulated Messina, affords a third instance of the same kind. By an authentic relation of it, published here *, we are informed, that a Genoese vessel from the Levant, arrived at that city; and upon notice given that a sailor who had touched some cases of cotton stuffs bought up at Patrasso in the Morea, where the distemper then raged, was dead of the plague, in the voyage; the ship was put under quarantine; during which time the cotton stuffs were privately landed. The master and some sailors dying three days after, the vessel was burnt. These goods lay for some time concealed, but were soon after publicly sold: upon which the disease immediately broke out in that quarter where they were opened; and afterwards was spread through the whole city.

I think it not improper, for the fuller confirmation of the present point, to give a relation commu-

* Vid. the London gazette, July 23. 1743.

nicated to me by a person of unquestionable credit, of the like effect from goods, in respect to the small-pox; which distemper is frequently carried in the nature of the plague to both the East and West Indies from these countries, and was once carried from the East Indies to the Cape of Good Hope, in the following manner. About the year 1718, a ship from the East Indies arrived at that place: in the voyage three children had been sick of the small-pox: the foul linen used about them was put into a trunk and locked up. At the ship's landing, this was taken out; and given to some of the natives to be washed: upon handling the linen, they were immediately seized with the small-pox, which spread into the country for many miles, and made such a desolation, that it was almost dispeopled.

It has been thought so difficult to explain the manner how goods retain the seeds of contagion, that some authors * have imagined infection to be performed by the means of insects; the eggs of which may be conveyed from place to place, and make the disease when they come to be hatched. But as this is a supposition grounded upon no manner of observation, so I think there is no need to have recourse to it. If, as we have conjectured, the matter of contagion be an active substance generated chiefly from animal corruption, it is not hard to conceive how this may be lodged and preserved in soft porous bodies, which are kept pressed close together.

We all know how long a time perfumes hold their scent, if wrapt up in proper coverings: and it is very remarkable, that the strongest of these, like the

* Kircher, Langius, &c.

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matter we are treating of, are mostly animal juices, as musk, civet, &c. and that the substances found most fit to keep them in, are the very same with those which are most apt to receive and communicate infection, as furs, feathers, silk, hair, wool, cotton, flax, &c. the greatest part of which are likewise of the animal kind.

Nothing indeed can give us so just a notion of infection, and more clearly represent the manner of it, than odoriferous bodies. Some of these do strangely revive the animal spirits; others instantaneously depress and sink them: we may therefore conceive, that what active particles emitted from any such substances do, is in the like way done by pestiferous bodies; so that contagion is no more than the effect of volatile offensive matter drawn into the body by our smelling.

The third cause we assigned for the spreading of contagion, was a corrupted state of air. Although the air be in a right state, yet a sick person may infect those who are very near him; as we find the pestilence to continue sometimes among the crew of a ship, after they have sailed out of the infectious air wherein the disease was first caught. A remarkable accident of this nature is recorded to have happened in the plague at Genoa in the year 1656. Eleven persons put to sea in a felucca, with design to withdraw themselves from the contagion, and retire into Provence; but one of them falling sick of the plague soon after they had embarked, infected the rest; inso-much that others being taken ill, and dying in their turns, they were not admitted any where, but were forced to return from whence they came: and by
that

that time the boat arrived again at Genoa, no more than one of them survived *.

However, in this case the malady does not usually spread far, the contagious particles being soon dispersed and lost. But when in a corrupt disposition of the air the contagious particles meet with the subtile parts generated by that corruption, by uniting with them they become much more active and powerful, and likewise of a more durable nature ; so as to form an infectious matter capable of conveying the mischief to a greater distance from the diseased body, out of which it was produced.

In general, a hot air is more disposed to spread contagion than a cold one, as no one can doubt, who considers how much all kinds of effluvia are farther diffused in a warm air, than in the contrary. But moreover, that state of air, when unseasonable moisture and want of winds are added to its heat, which gives birth to the plague in some countries, will doubtless promote it in all. For Hippocrates sets down the same description of a pestilential state of air in his country, as the Arabians do of the constitution which gives rise to the plague in Africa †. Mercurialis assures us the same constitution of air attended the pestilence in his time at Padua ‡: and Gas-sendus observed the same in the plague of Digne §.

* Toulon, traité de la peste. † Hippocr. epil. l. iii. That Hippocrates describes here the constitution of air accompanying the true plague, contrary to what some have thought, Galen testifies in his comment upon this place, in libr. de temper. l. i. c. 4. and in libr. de differentiis febr. lib. i. c. 4.

‡ Vid. Mercurial prælect. de pestilent.

§ Notitia eccles. Din. entis.

Besides,

Besides, it is easy to shew how the air, by the sensible ill qualities discoursed of in the last chapter, should favour infectious diseases, by rendering the body obnoxious to them.

Indeed other hurtful qualities of the air are more to be regarded than its heat alone : for the plague is sometimes stopt, while the heat of the season increases, upon the emendation of the air in other respects. At Smyrna the plague, which is yearly carried thither by ships, constantly ceases about the 24th of June, by the dry and clear weather they always have at that time ; the unwholesome damps being then dissipated that annoy the country in the spring. However, the heat of the air is of so much consequence, that if any ship brings it in the winter-months of November, December, January, or February, it never spreads ; but if later in the year, as in April or afterwards, it continues till the time before mentioned.

But moreover, what was said before of some latent disorders in the air having a share in spreading the plague, will likewise have place in these countries ; as the last plague in the city of London remarkably proves, the seeds of which, upon its first entrance, and while it was confined to a house or two, preserved themselves through a hard frosty winter, and again put forth their malignant quality as soon as the warmth of the spring gave them force : but, at the latter end of the next winter, they were suppressed so as to appear no more, though in the month of December more than half the parishes of the city were infected.

A corrupted state of air is, without doubt, necessary to give these contagious atoms their full force ;
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for otherwise it were not easy to conceive how the plague, when once it had seized any place, should ever cease but with the destruction of all the inhabitants : which is readily accounted for by supposing an emendation of the qualities of the air, and the restoring of it to a healthful state capable of dissipating and suppressing the malignity.

On the other hand, it does not appear, that the air, however corrupted, is usually capable of carrying infection to a very great distance ; but that commonly the plague is spread from town to town by infected persons and goods : for there are numberless instances where the plague has caused a great mortality in towns, while other towns and villages, very near them, have been entirely free. And hence it is, that the plague sometimes spreads from place to place very irregularly. Thuanus * speaks of a plague in Italy, which one year was at Trent and Verona, the next got into Venice and Padua, leaving Vicenza, an intermediate place, untouched, though the next year that also felt the same stroke : a certain proof that the plague was not carried by the air from Verona to Padua and Venice ; for the infected air must have tainted all in its passage. We have had lately in France one instance of the same nature, when the plague was carried at once out of Provence several leagues into the Gevaudan. Usually indeed the plague, especially when more violent than ordinary, spreads from infected places into those which border upon them : which probably is sometimes effected by some little communication infected towns are obliged to hold with the country about them for the sake of ne-

* Histor. lib. lxii.

cessaries,

cessaries, the subtilty of the venom now and then eluding the greatest precautions ; and at other times by such as withdraw themselves from infected places into the neighbourhood.

I own it cannot be demonstrated, that when the plague makes great ravage in any town, the number of sick shall never be great enough to load the air with infectious effluvia, emitted from them in such plenty, that they may be conveyed by the winds into a neighbouring town or village, without being dispersed so much as to hinder their producing any ill effects ; especially since it is not unusual for the air to be so far charged with these noxious atoms, as to leave no place within the infected town secure : infomuch that when the distemper is at its height, all shall be indifferently infected, as well those who keep from the sick, as those who are near them ; though, at the beginning of a plague, to avoid all communication with the diseased, is an effectual defence. However, I do not think this is often the case : just as the smoke with which the air of the city of London is constantly impregnated, especially in winter, is not carried many miles distant ; though the quantity of it is vastly greater than the quantity of infectious effluvia, that the most mortal plague could generate.

But, to conclude what relates to the air, since the ill qualities of it in these northern countries are not alone sufficient to excite the plague, without imported contagion, this shews the error of a common opinion, countenanced by authors of great name *, that we are necessarily visited with the plague once in thirty or forty years : which is a mere fancy, without

* Sydenham de peste.

foundation either in reason or experience; and therefore people ought to be delivered from such vain fears. Since the pestilence is never originally bred with us, but always brought accidentally from abroad, its coming can have no relation to any certain period of time. And although our three or four last plagues have fallen out nearly at such intervals, yet that is much too short a compass of years to be a foundation for a general rule. Accordingly we see that almost fourscore years have passed over without any calamity of this kind.

The air of our climate is so far from being ever the original of the true plague, that most probably it never produces those milder infectious distempers, the small-pox and measles. For these diseases were not heard of in Europe before the Moors had entered Spain: and (as I have observed in the preface) they were afterwards propagated and spread through all nations, chiefly by means of the wars with the Saracens.

Moreover, we are so far from any necessity of these periodical returns of the plague, that, on the contrary, though we have had several strokes of this kind, yet there are instances of bad contagions from abroad being brought over to us, which have proved less malignant here, when our northern air has not been disposed to receive such impressions.

The sweating sickness, before hinted at, called *Sudor Anglicus* and *Febris Ephemera Britannica*, because it was commonly thought to have taken its rise here, was most probably of a foreign original: and though not the common plague with glandular tumours, and carbuncles, yet a real pestilence from the
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same cause, only altered in its appearance, and abated in its violence, by the salutary influence of our climate. For it preserved an agreement with the common plague in many of its symptoms, as excessive faintness and inquietudes, inward burnings, &c. these symptoms being no where observed in so intense a degree as here they are described to have been, except in the true plague: and, what is much more, it was likewise a contagious disease.

The first time this was felt here, which was in the year 1485, it began in the army with which King Henry VII. came from France and landed in Wales*: and it has been supposed by some to have been brought from the famous siege of Rhodes by the Turks three or four years before, as may be collected from what Dr Keyes says in one place of his treatise on this disease†. Besides, of the several returns which this has made since that time, viz. in the years 1506, 1517, 1528, and 1551, that in the year 1528 may very justly be suspected to have been owing to the common pestilence, which at those times raged in Italy‡, as I find one of our historians has long ago conjectured§: and the others were very probably from a Turkish infection. If at least some of these returns were not owing to the remains of former attacks, a suitable constitution of air returning to put the latent seeds in action before they were quite destroyed. It is the more probable that this

* Vid. Caium de febr. ephemer. Britan. and Lord Bacon's history of Henry VII.

† Pag. 162. edit.

Lovan.

‡ Vid. Rondinelli contagio in Firenze,

& Summonte histor. di Napoli.

§ Lord Herbert's

history of Henry VIII.

disease was owing to imported contagion ; because we are assured, that this form of the sickness was not peculiar to our island, but that it made great destruction with the same symptoms in Germany, and other countries *.

I call this distemper a plague with lessened force : because though its carrying off thousands for want of right management was a proof of its malignity, which indeed in one respect exceeded that of the common plague itself, (for few, who were destroyed with it, survived the seizure above one natural day), yet its going off safely with profuse sweats in twenty-four hours, when due care was taken to promote that evacuation, shewed it to be what a learned and wise historian calls it, rather a surprise to nature, than obstinate to remedies ; who assigns this reason for expressing himself thus, that if the patient was kept warm with temperate cordials, he commonly recovered †. And, what I think yet more remarkable, sweating, which was the natural crisis of this distemper, has been found by great physicians the best remedy against the common plague : by which means, when timely used, that distemper may sometimes be carried off without any external tumours. Nay besides, a judicious observer informs us, that in many of his patients, when he had broken the violence of the distemper by such an artificial sweat, a natural sweat not excited by medicines would break forth exceedingly refreshing ‡.

And I cannot but take notice, as a confirmation of what I have been advancing, that we had here the same kind of fever in the year 1713, about the

* Thuani histor. lib. v. † Lord Verulam's history of Henry VII. ‡ Vid. Sydenham de peste, ann. 1665. month

month of September, which was called the *Dunkirk fever*, as being brought by our soldiers from that place. This probably had its original from the plague, which a few years before broke out at Dantzic, and continued some time among the cities of the north. With us this fever began only with a pain in the head, and went off in large sweats usually after a day's confinement : but at Dunkirk it was attended with the additional symptoms of vomiting, diarrhœa, &c.

To return from this digression : From all that has been said, it appears, I think, very plainly, that the plague is a real poison, which being bred in the southern parts of the world, is carried by commerce into other countries, particularly into Turkey, where it maintains itself by a kind of circulation from persons to goods : which is chiefly owing to the negligence of the people there, who are stupidly careless in this affair. That when the constitution of the air happens to favour infection, it rages there with great violence : that at that time more especially diseased persons give it to one another, and from them contagious matter is lodged in goods of a loose and soft texture, which being packed up and carried into other countries, let out, when opened, the imprisoned seeds of contagion, and produce the disease whenever the air is disposed to give them force ; otherwise they may be dissipated without any considerable ill effects. And lastly, that the air does not usually diffuse and spread these to any great distance, if intercourse and commerce with the place infected be strictly prevented.

P A R T II.

Of the METHODS to be taken against the
PLAGUE.

C H A P. I.

Of preventing infection from other countries.

AS it is a satisfaction to know, that the plague is not a native of our country, so this is likewise an encouragement to the utmost diligence in finding out means to keep ourselves clear from it.

This caution consists of two parts : The preventing its being brought into our island ; and, if such a calamity should happen, the putting a stop to its spreading among us.

The first of these is provided for by the established method of obliging ships that come from infected places, to perform quarantine : as to which, I think it necessary, that the following rules be observed.

Near to our several ports, there should be lazarettoes built in convenient places, on little islands, if it can so be, for the reception both of men and goods, which arrive from places suspected of infection : the keeping men in quarantine on board the ship being not sufficient ; the only use of which is to observe whether any die among them. For infection may be preserved so long in cloaths, in which it is once lodged, that as much, nay more of it, if sickness continues in the ship, may be brought on shore at the end than at the beginning of forty days : unless a new quarantine be begun every time any person dies ;
which

which might not end but with the destruction of the whole ship's crew.

If there has been any contagious distemper in the ship; the sound men should leave their cloaths, which should be sunk in the sea, the men washed and shaved, and having fresh cloaths, should stay in the lazaretto thirty or forty days. The reason of this is, because persons may be recovered from a disease themselves, and yet retain matter of infection about them a considerable time; as we frequently see the small-pox taken from those who have several days before passed through the distemper.

The sick, if there be any, should be kept in houses remote from the sound, and, some time after they are well, should also be washed and shaved; and have fresh cloaths; whatever they wore while sick being sunk or buried: and then being removed to the houses of the sound, should continue there thirty or forty days.

I am particularly careful to destroy the cloaths of the sick, because they harbour the very quintessence of contagion. A very ingenious author *, in his admirable description of the plague at Florence in the year 1348, relates what himself saw: That two hogs finding in the streets the rags which had been thrown out from off a poor man dead of the disease, after snuffling upon them, and tearing them with their teeth, they fell into convulsions, and died in less than an hour. The learned Fraecastorius acquaints us, that in his time, there being a plague in Verona, no less than twenty-five persons were successively killed

* Boccaccio Decameron. giornat. prim.

by the infection of one fur garment *. And Forrestus gives a like instance of seven children, who died by playing upon cloaths brought to Alckmaer in North Holland, from an infected house in Zealand †. The late Mr Williams, chaplain to Sir Robert Sutton, when ambassadour at Constantinople, used to relate a story of the same nature told him by a bassa : That in an expedition this bassa made to the frontiers of Poland, one of the janisaries under his command died of the plague; whose jacket, a very rich one, being bought by another janisary, it was no sooner put on, but he also was taken sick, and died : and the same misfortune befel five janisaries more, who afterwards wore it. This the bassa related to Mr Williams, chiefly for the sake of this farther circumstance, that the incidents now mentioned prevailed upon him to order the burning of the garment: designing by this instance to let Mr Williams see there were Turks who allowed themselves in so much freedom of thought, as not to pay that strict regard to the Mahometan doctrine of fatality, as the vulgar among them do.

If there has been no sickness in the ship; I see no reason why the men should perform quarantine. Instead of this, they may be washed, and their cloaths aired in the lazaretto, as goods, for one week.

But the greatest danger is from such goods as are apt to retain infection, such as cotton, hemp, and flax, paper or books, silk of all sorts, linen, wool, feathers, hair, and all kinds of skins. The lazaretto for these should be at a distance from that for the

* De contagione, l. iii. c. 7. † Observat. l. vi. schol. ad observ. 22.

men ; and they must in convenient warehouses be unpacked, and exposed, as much as may be, to the fresh air for forty days.

This may perhaps seem too long ; but as we do not know how much time precisely is necessary to purge the interstices of spongy substances from infectious matter by fresh air, the caution cannot be too great in this point. Certainly the time here proposed, having been long established by general custom, ought not in the least to be retrenched ; unless there could be a way found out of trying when bodies have ceased to emit the noxious fumes. Possibly this might be discovered by putting tender animals near to them, particularly little birds : because it has been observed, in times of the plague, that the country has been forsaken by the birds ; and those kept in houses have many of them died *. Now, if it should be found, that birds let loose among goods at the beginning of their quarantine, are obnoxious to the contagion in them, it may be known, in good measure, when such goods are become clean, by repeating the trial till birds let fly among them receive no hurt. But the use of this expedient can be known only by experience. In the mean time, I own I am fond of the thought, in compassion to poor labourers, who must expose their lives to danger, in the attendance upon this work : and though I am well aware that there are plagues among animals, which do not indifferently affect all kinds of them, some being confined to a particular species, (like the disease of the black cattle here, a few years since, which neither proved infectious to other brutes, nor to men) ; yet it has al-

* Diemerbroeck de peste, l. i. c. 4.

ways been observed that the true plague among men has been destructive to all creatures of what kind soever.

A very remarkable story, lately communicated to me by a person of undoubted credit, is too much to the purpose to be here omitted. The fact is this. In the year 1726, an English ship took in goods at Grand Cairo, in the time of the plague's raging there, and carried them to Alexandria. Upon opening one of the bales of wool in a field, two Turks employed in the work were immediately killed; and some birds, which happened to fly over the place, dropped down dead.

However, the use of quarantines is not wholly frustrated by our ignorance of the exact time required for this purification: since the quarantine does at least serve as a trial whether goods are infected or not; it being hardly possible that every one of those who are obliged to attend upon them, can escape hurt if they are so. And, whenever that happens, the goods must be destroyed!

I take it for granted, that the goods should be opened, when they are put into the lazaretto, otherwise their being there will avail nothing. This is the constant practice in the ports of Italy. That it is so at Leghorn, appears by the account lately published of the manner in which quarantines are there performed: and I find, that the same rule is observed at Venice, from an authentic paper I have before me, containing the methods made use of in that city, where quarantines have been enjoined ever since the year 1484; at which time, as far as I can learn, they were first instituted in Europe. In that place all
bales

bales of cotton, of camel's or of beaver's hair, and the like, are ript open from end to end, and holes made in them by the porters every day, into which they thrust their naked arms, in order that the air may have free access to every part of the goods. That some such cautions as these ought not to be omitted, is clearly proved by the misfortune which happened in the island of Bermudas about the year 1695; where, as the account was given me by the learned Dr Halley, a sack of cotton put on shore by stealth, lay above a month without any prejudice to the people of the house where it was hid: but when it came to be distributed among the inhabitants, it carried such a contagion along with it, that the living scarce sufficed to bury the dead. This relation Dr Halley received from Captain Tucker of Bermudas, brother to Mr Tucker, late under-secretary in our secretary's office.

Indeed, as it has been frequently experienced, that of all the goods which harbour infection, cotton in particular is the most dangerous, and Turkey is almost a perpetual seminary of the plague; I cannot but think it highly reasonable, that whatever cotton is imported from that part of the world, should at all times be kept in quarantine; because it may have imbibed infection at the time of its packing up, notwithstanding no mischief has been felt from it by the ship's company. And the length of time from its being packed up to its arrival here, is no certain security that it is cleared from the infection. At least, it is found, that the time employed by ships in passing between Turkey and Marseilles, is not long enough for goods to lose their infection: as appears
not

not only from the late instance, but also from an observation made in a certain memorial drawn up by the deputy of trade at Marseilles *. Marseilles is the only port in France allowed to receive goods from the Levant, on account of its singular convenience for quarantines, by reason of several small islands situate about it. The ports of France in the western ocean having had a desire to be allowed the same liberty, their deputies presented, in the year 1701, a memorial to the royal council of trade, containing several reasons for their pretensions. To this the deputy at Marseilles makes reply in the memorial I am speaking of, in which this advantage of Marseilles for quarantines above the other ports, is much insisted upon: and, to evince the importance thereof, it is declared in express words, that many times persons have been found in that place to die of the plague in their attendance upon goods under quarantine. Now, if it be certain, that goods have retained infection during their passage from Turkey to Marseilles; it is too hardy a presumption to be admitted in an affair so important as this, that they must necessarily lose all contagion in the time of their coming to us, because the voyage is something longer. But besides this, there are some few instances of goods, that have retained their infection many years. In particular, Alex. Benedictus gives a very distinct relation of a feather-bed, that was laid by seven years on suspicion of its being infected, which produced mischievous effects at the end of that great length of time †. And Sir Theodore Mayerne relates, that

* Memorials presented by the deputies of the council of trade, in France, to the royal council, pag 44. and 45.

† Alex. Benedict. de peste, cap. 3.

some cloaths fouled with blood and matter from plague-sores: being lodged between matting and the wall of a house in Paris, gave the plague several years after to a workman, who took them out, which presently spread through the city*.

What makes cotton so eminently dangerous, is its great aptitude to imbibe and retain any sort of effluvia near it; of which I have formerly made a particular experiment, by causing some cotton to be placed for one day near a piece of putrefying flesh from an amputated limb, in a bell-glass, but without touching it; for the cotton imbibed so strong a taint, that being put up in a close box, it retained its offensive scent above ten months, and would, I believe, have kept it for years. If, instead of the fumes of putrefied flesh from a sound body, this cotton had been thus impregnated with the fumes of corrupted matter from one sick of the plague; I make no doubt but it would have communicated infection. And the experiment would have succeeded alike in both cases, if instead of cotton, silk, wool, or hair had been inclosed in the vessel; animal substances being the most apt to attract the volatile particles, which come from bodies of the same nature with themselves.

As all reasonable provisions should be made both for the sound and sick, who perform quarantine; so the strict keeping of it ought to be enforced by the severest penalties. And if a ship comes from any place, where the plague raged, at the time of the ship's departure from it, with more than usual vio-

* In a paper of advice against the Plague, laid before the king and council by Sir Theod. Mayerne, in the year

1631. MS.

lence ; it will be the securest method to sink all the goods, and even the ship sometimes ; especially if any on board have died of the disease.

Nor ought this further caution to be omitted, that when the contagion has ceased in any place by the approach of winter, it will not be safe to open a free trade with it too soon ; because there are instances of the distemper's being stopt by the winter-cold, and yet the seeds of it not destroyed, but only kept unactive, till the warmth of the following spring has given them new life and force. Thus in the great plague at Genoa about fourscore years ago, which continued part of two years, the first summer about ten thousand died, the winter following hardly any ; but the summer after no less than sixty thousand. Likewise the last plague at London appeared the latter end of the year 1664, and was stopt during the winter by a hard frost of near three months continuance ; so that there remained no farther appearance of it till the ensuing spring *. Now, if goods brought from such a place should retain any of the latent contagion, there will be danger of their producing the same mischief in the place to which they are brought as they would have caused in that from whence they came.

But, above all, it is necessary, that the clandestine importing of goods be punished with the utmost rigour ; from which wicked practice I should always apprehend more danger of bringing the disease, than by any other way whatsoever.

These are, I think, the most material points, to which regard is to be had in defending ourselves a-

* Hodges de peste.

gainst contagion from other countries. The particular manner of putting these directions in execution, as the visiting of ships, regulation of lazarettoes, &c. I leave to proper officers, who ought sometimes to be assisted herein by able physicians.

C H A P. II.

Of stopping the progress of the plague, if it should enter our country.

THE next consideration is; what to do in case, through a miscarriage in the public care, by the neglect of officers, or otherwise, such a calamity should be suffered to befall us:

There is no evil in the world, in which the great rule of resisting the beginning, more properly takes place, than in the present case; and yet it has unfortunately happened, that the common steps formerly taken have had a direct tendency to hinder the putting this maxim in practice.

As the plague always breaks out in some particular place, it is certain, that the directions of the civil magistrate ought to be such, as to make it as much for the interest of infected families to discover their misfortune, as it is, when a house is on fire, to call in the assistance of the neighbourhood: whereas, on the contrary, the methods taken by the public, on such occasions, have always had the appearance of a severe discipline, and even punishment, rather than of a compassionate care; which must naturally make the infected conceal the disease as long as was possible.

The main import of the orders issued out at these

times was *; as soon as it was found, that any house was infected, to keep it shut up, with a large red cross, and these words, *Lord, have mercy upon us*, painted on the door; watchmen attending day and night to prevent any one's going in or out, except such physicians, surgeons, apothecaries, nurses, searchers, &c. as were allowed by authority; and this to continue at least a month after all the family was dead or recovered.

It is not easy to conceive a more dismal scene of misery than this: families locked up from all their acquaintance, though seized with a distemper which the most of any in the world requires comfort and assistance; abandoned it may be to the treatment of an inhumane nurse, (for such are often found at these times about the sick); and strangers to every thing but the melancholy sight of the progress death makes among themselves: with small hopes of life left to the survivors, and those mixed with anxiety and doubt, whether it be not better to die, than to prolong a miserable being, after the loss of their best friends and nearest relations.

If fear, despair, and all dejection of spirits, dispose the body to receive contagion, and give it a great power, where it is received, as all physicians agree they do; I do not see how a disease can be more enforced than by such a treatment.

Nothing can justify such cruelty, but the plea, that it is for the good of the whole community, and prevents the spreading of infection. But this upon due

* Vid. Directions for the cure of the plague, by the college of physicians; and orders by the lord mayor and aldermen of London, published 1665,

consideration will be found quite otherwise : for while contagion is kept nursed up in a house, and continually increased by the daily conquests it makes, it is impossible but the air should become tainted in so eminent a degree, as to spread the infection into the neighbourhood upon the first outlet. The shutting up houses in this manner is only keeping so many seminaries of contagion, sooner or later to be dispersed abroad : for the waiting a month, or longer, from the death of the last patient, will avail no more than keeping a bale of infected goods unpacked ; the poison will fly out, whenever the Pandora's box is opened.

As these measures were owing to the ignorance of the true nature of contagion, so they did, I firmly Believe, contribute very much to the long continuance of the plague, every time they have been practised in this city ; and, no doubt, they have had as ill effects in other countries :

It is therefore no wonder, that grievous complaints were often made against this unreasonable usage ; and that the citizens were all along under the greatest apprehensions of being thus shut up. This occasioned their concealing the disease as long as they could, which contributed very much to the enforcing and spreading of it : and when they were confined, it often happened that they broke out of their imprisonment, either by getting out at windows, &c. or by bribing the watchmen at their doors ; and sometimes even by murdering them. Hence in the nights, people were often met running about the streets, with hideous shrieks of horror and despair, quite distracted, either from the violence of the fever, or from the

terrors of mind, into which they were thrown by the daily deaths they saw of their nearest relations.

In these miserable circumstances, many ran away; and when they had escaped, either went to their friends in the country, or built huts or tents for themselves in the open fields, or got on board ships lying in the river. A few also were saved by keeping their houses close from all communication with their neighbours*.

And it must be observed, that whenever popular clamours prevailed so far, as to procure some release for the sick, this was remarkably followed with an abatement of the disease. The plague, in the year 1636, began with great violence; but leave being given by the king's authority for people to quit their houses, it was observed, that not one in twenty of the well persons removed fell sick, nor one in ten of the sick died†. Which single instance alone, had there been no other, should have been of weight ever after to have determined the magistracy against too strict confinements. But besides this, a preceding plague, viz. in the year 1625, affords us another instance of a very remarkable decrease upon the discontinuing to shut up houses. It was indeed so late in the year before this was done, that the near approach of winter was doubtless one reason for the diminution of the disease which followed: yet this was so very great, that it is at least past dispute, that the liberty then permitted was no impediment to it. For this opening of the houses was allowed of in the beginning of September: and whereas the last week in August, there died no less

* Vid. A journal of the plague in 1665, by a citizen. London, 1722. † Discourse upon the air, by Tho. Cock. than

than four thousand two hundred and eighteen, the very next week the burials were diminished to three thousand three hundred and forty-four; and in no longer time than to the fourth week after, to eight hundred and fifty-two *.

Since therefore the management in former times neither answers the purpose of discovering the beginning of the infection, nor of putting a stop to it when discovered, other measures are certainly to be taken; which, I think, should be of this nature.

There ought, in the first place, a council of health to be established, consisting of some of the principal officers of state, both ecclesiastical and civil, some of the chief magistrates of the city, two or three physicians, &c. And this council should be intrusted with such powers, as might enable them to see all their orders executed with impartial justice, and that no unnecessary hardships, under any pretence whatever, be put upon any by the officers they employ.

Instead of ignorant old women, who are generally appointed searchers in parishes to inquire what diseases people die of, that office should be committed to understanding and diligent men: whose business it should be, as soon as they find any have died after an uncommon manner, particularly with livid spots, bubo's, or carbuncles, to give notice thereof to the council of health; who should immediately send skilful physicians to examine the suspected bodies, and to visit the houses in the neighbourhood, especially of the poorer sort, among whom this evil generally begins. And if upon their report it appears, that a pestilential

* Vid. The shutting up houses soberly debated, anno 1665.

distemper is broken out, they should without delay order all the families in which the sickness is, to be removed; the sick to different places from the sound: but the houses for both should be three or four miles out of town; and the sound people should be stripped of all their cloaths, and washed and shaved, before they go into their new lodgings. These removals ought to be made in the night, when the streets are clear of people: which will prevent all danger of spreading the infection. And besides, all possible care should be taken to provide such means of conveyance for the sick, that they may receive no injury.

As this management is necessary with respect to the poor and meaner sort of people; so the rich, who have conveniences, may, instead of being carried to lazarettoes, be obliged to go to their country-houses; provided that care be always taken to keep the sound separated from the infected. And at the same time all the inhabitants who are yet well, should be permitted, nay encouraged to leave the town, which the thinner it is, will be the more healthy.

No manner of compassion and care should be wanting to the diseased; to whom, when lodged in clean and airy habitations, there would, with due cautions, be no great danger in giving attendance. All expenses should be paid by the public, and no charges ought to be thought great, which are counterbalanced with the saving a nation from the greatest of calamities. Nor does it seem to me at all unreasonable, that a reward should be given to the person that makes the first discovery of infection in any place; since it is undeniable, that the making known the evil to those who are provided with proper methods

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thods against it, is the first and main step towards the overcoming it.

Although the methods taken in other countries, as well as in our own, have generally been different from what we have here recommended; yet there are not wanting some instances of extraordinary success attending these measures, whenever they have happened to be put in practice.

The magistrates of the city of Ferrara in Italy, in the year 1630, when all the country round about them was infected with the plague, observing the ill success of the conduct of their neighbours, who, for fear of losing their commerce, did all they could to conceal the disease, by keeping the sick in their houses, resolved, whenever occasion should require, to take a different method. Accordingly, as soon as they received information, that one had died in their city of the pestilence, they immediately removed the whole family he belonged to into a lazaretto, where all, being seven in number, likewise died. But though the disease was thus malignant, it went no farther, being suppressed at once by this method. Within the space of a year the same case returned seven or eight times, and this management as often put a stop to it. The example of this city was afterwards followed more than once by some other towns in the same territory, with so good success, that it was thought expedient, for the common good, to publish, in the memoirs of the people of Ferrara, this declaration: That the only remedy against the plague is to make the most early discovery of it, that is possible, and thus to extinguish it in the very beginning *.

* Muratori governo della peste, lib. i. c. 5.

No less remarkable than this occurrence at Ferrara, is what happened at Rome in the plague I have taken notice of before, in the year 1657. When the disease had spread itself among both rich and poor, and raged in the most violent manner; the Pope appointed Cardinal Gastaldi, to be commissary-general of health, giving him for a time the power of the whole sacred college, with full commission to do whatever he should judge necessary. Hereupon he gave strict orders, that no sick or suspected persons should stay in their own houses. The sick he removed, upon the first notice, to a lazaretto in the island of the Tiber; and all who were in the same houses with them to other hospitals just without the city, in order to be sent to the island, if they should fall sick. At the same time he took diligent care to send away their goods to an airy place to be cleansed. He executed these regulations with so much strictness, that no persons of the highest quality were exempted from this treatment; which occasioned at first great complaints against the Cardinal for his severity; but soon after he had general thanks: for in two months time, by this means, he entirely cleared the city of the pestilence, which had continued in it almost two years. And it was particularly observed, that whereas before, when once the disease had got into a house, it seldom ended without seizing the whole family; in this management scarce five out of an hundred of the sound persons removed were infected *.

I cannot but take notice, that the plague was stopped at Marseilles a full fortnight by the same measures, and probably might have been wholly extinguished,

* Cardin. Gastaldi. de avertenda peste, c. 10.

had not new force been given it by the unseasonable confidence of the inhabitants upon this intermission: which, we are informed, was so great, that they would not believe the pestilence had been at all among them, and publicly upbraided the physicians and surgeons for frightening them causelessly *. At this time, no doubt, they must have neglected the cautions necessary for their security so much, as to leave us no room to be surpris'd, that the disease should after this break out again with too great violence to be a second time overcome.

But, besides these examples in foreign countries, we have one instance of the same nature nearer home. When the plague was last here in England, upon its first entrance into Poole in Dorsetshire, the magistrates immediately suppress'd it, by removing the sick into pest-houses, without the town, as is well remembered there to this time. A very remarkable occurrence has greatly contributed towards preserving all the circumstances of this transaction in memory. They found some difficulty in procuring any one to attend upon the sick after their removal: which oblig'd the town to engage a young woman, then under sentence of death, in that service, on a promise to use their interest for obtaining her pardon. The young woman escap'd the disease, but neglecting to solicit the corporation for the accomplishment of their engagement with her, three or four months after she was barbarously hanged by the mayor upon a quarrel between them.

I would have it here observ'd, that as the advice

* Journal d. ce qui s'est passé à Marseilles, &c. p. 9.

I have been giving is founded upon this principle, that the best method for stopping infection, is to separate the healthy from the diseased; so in small towns and villages, where it is practicable, if the sound remove themselves into barracks, or the like airy habitations, it may probably be even more useful, than to remove the sick. This method has been found beneficial in France after all others have failed. But the success of this proves the method of removing the sick, where this other cannot be practised, to be the most proper of any.

When the sick families are gone, all the goods of the houses in which they were, should be buried deep under ground. This I prefer to burning them: because, especially in a close place, some infectious particles may possibly be dispersed by the smoke through the neighbourhood; according to what Mercurialis relates, that the plague in Venice was augmented by burning a large quantity of infected goods in the city*. A learned physician of my acquaintance lately communicated to me the relation of a case, (given to him by an apothecary, who was at the place when the thing happened), very proper to be here mentioned. The story is this. At Shipston, a little town upon the river Stour in Worcestershire, a poor vagabond was seen walking in the streets with the small-pox upon him. The people frightened took care to have him carried to a little house, seated upon a hill, at some distance from the town, providing him with necessaries. In a few days the man died. They ordered him to be buried deep in the ground, and the house with his cloaths to be burnt. The wind being

* De pestilent. cap. 21.

pretty high, blew the smoke upon the houses on one side of the town : in that part, a few days after, eight persons were seized with the small-pox. So dangerous is heat in all kinds of pestilential distempers, and so diffusive of contagion. And moreover, the houses themselves may likewise be demolished or pulled down, if that can conveniently be done ; that is, if they are remote enough from others : otherwise it may suffice to have them thoroughly cleansed, and then plastered up. And after this, all possible care ought still to be taken to remove whatever causes are found to breed and promote contagion. In order to this, the overseers of the poor (who might be assisted herein by other officers) should visit the dwellings of all the meaner sort of the inhabitants ; and where they find them stifled up too close and nasty, should lessen their number by sending some into better lodgings, and should take care, by all manner of provision and encouragement, to make them more cleanly and sweet.

No good work carries its own reward with it so much as this kind of charity : and therefore, be the expense what it will, it must never be thought unreasonable. For nothing approaches so near to the first original of the plague, as air pent up, loaded with damps, and corrupted with the filthiness that proceeds from animal bodies.

Our common prisons afford us an instance of something like this, where very few escape what they call the gaol-fever, which is always attended with a degree of malignity in proportion to the closeness and stench of the place : and it would certainly very well become the wisdom of the government, as well with regard

to the health of the town, as in compassion to the prisoners, to take care, that all houses of confinement should be kept as airy and clean, as is consistent with the use to which they are designed.

The black affize at Oxford, held in the castle there in the year 1577, will never be forgot *; at which the judges, gentry, and almost all that were present, to the number of three hundred, were killed by a poisonous steam, thought by some to have broken forth from the earth; but by a noble and great philosopher † more justly supposed to have been brought by the prisoners out of the gaol into court; it being observed, that they alone were not injured by it.

At the same time that this care is taken of houses, the proper officers should be strictly charged to see that the streets be washed and kept clean from filth, carrion, and all manner of nuisances; which should be carried away in the night-time: nor should the laystalls be suffered to be too near the city. Beggars and idle persons should be taken up, and such miserable objects as are neither fit for the common hospitals nor workhouses, should be provided for in an hospital of incurables.

Orders indeed of this kind are necessary to be observed at all times, especially in populous cities; and therefore I am sorry to take notice, that in these of London and Westminster there is no good police established in these respects: for want of which the citizens and gentry are every day annoyed more ways than one.

* Camden. annal. Regin. Elisab. † Lord Verulam, natural history, cent. 10. num. 194.

If these early precautions we have mentioned, prove successful, there will be no need of any methods for correcting the air, purifying houses, or of rules for preserving particular persons from infection: to all which, if the plague get head, so that the sick are too many to be removed, (as they will be when the disease has raged for a considerable time), regard must be had.

As to the first, fire has been almost universally recommended for this purpose, both by the ancients and moderns, who have advised to make frequent and numerous fires in the towns infected. This precept, I think, is almost entirely founded upon a tradition, that Hippocrates put a stop to a plague in Greece by this means. But it is to be observed, that there is no mention made of any thing like it in the works of Hippocrates. The best authority we have for it, is the testimony of Galen, though it is also mentioned by other authors. Galen, recommending Theriaca against the pestilence, has thought fit, it seems, to compare it to fire; and, upon this conceit, relates, that Hippocrates cured a plague which came from Æthiopia into Greece by purifying the air with fires; into which were thrown sweet-scented herbs and flowers, together with ointments of the finest flavour. It is remarkable, that among the epistles ascribed to Hippocrates, which, though not genuine, yet are older than Galen, there is a decree said to be made by the Athenians in honour of this father of physicians, which, making mention of the service he had done his country in a plague, says only, that he sent his scholars into several parts, with proper instructions to cure the disease. By which it should seem, that this story of the fires

was hardly or not at all known at the time when these letters were compiled. And Soranus may yet more confirm us, that it was framed long after the death of Hippocrates : for Soranus only says in general, that Hippocrates foretold the coming of the pestilence, and took care of the cities of Greece ; without any mention of having used this particular expedient. Plutarch indeed speaks of a practice like this as commonly approved among physicians, which he makes use of to illustrate a certain custom of the Egyptians : of whom he says, that they purify the air by the fumes of resin and myrrh, as physicians correct the foulness, and attenuate the thicknes thereof in times of pestilence, by burning sweet-woods, juniper, cypress *, &c.

This I take to be the sum of what can be learned from antiquity in relation to this point ; from whence we may see, that writers have concluded a little too hastily for the use of common fires in this case, upon the authority and example of Hippocrates, though we should allow the fact as related by Galen : when it will not from thence appear that Hippocrates himself relied upon them ; since he thought it necessary to take in the assistance of aromatic fumes. But as this fact is not grounded upon sufficient authority, so it is needless to insist long upon it. The passage I have brought from Plutarch will better explain what was the sentiment of those physicians who approved the practice. It seems they expected from thence to dispel the thicknes and foulness of the air. And no doubt but such evil dispositions of the air as proceed from damps, exhalations, and the like, may be corrected even by common fires, and the predisposition

* Plutarch, lib. de Isid. & Osir.

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of it from these causes to receive infection sometimes removed. But I think this method, if it be necessary, should be put in practice before the coming of the pestilence. For when the distemper is actually begun, and rages, since it is known to be spread and increased by the heat of the summer, and on the contrary checked by the cold in winter; undoubtedly, whatever increases that heat, will so far add force to the disease: as Mercurialis takes notice, that smiths, and all those who worked at the fire, were most severely used in the plague at Venice in his time *. Whether the service fires may do by correcting any other ill qualities of the air, will counterbalance the inconvenience upon this account, experience only can determine: and the fatal success of the trials made here in the last plague, is more than sufficient to discourage any farther attempts of this nature. For fires being ordered in all the streets for three days together, there died in one night following no less than four thousand, (if we may believe Dr Hodges); whereas in any single week before or after, never twice that number were carried off †. And we find, that, upon making the same experiment in the last plague at Marseilles, the contagion was every day spread more and more through the city with increased rage and violence ‡.

What has been said of fires, is likewise to be understood of firing of guns; which some have too rashly advised. The proper correction of the air would

* De peste, c. 22.

† Hodges de peste, p. 24.

‡ Journal de la peste de Marseilles, p. 19. & relation historique de tout ce qui s'est passé à Marseilles pendant la dernière peste, p. 77.

be to make it fresh and cool: accordingly the Arabians *, who were best acquainted with the nature of pestilences, advise people to keep themselves as airy as possible, and to chuse dwellings exposed to the wind, situate high, and refreshed with running waters.

As for houses, the first care ought to be to keep them clean: for as nastiness is a great source of infection, so cleanliness is the greatest preservative; which shews us the true reason, why the poor are most obnoxious to contagious diseases. It is remarked of the Persians, that though their country is surrounded every year with the plague, they seldom or never suffer any thing by it themselves: and it is likewise known, that they are the most cleanly people of any in the world; and that many among them make it a great part of their religion to remove filthiness and nuisances of every kind from all places about their cities and dwellings †.

Besides this, the Arabians advise the keeping houses cool, as another method of their purification; and therefore, to answer this end more fully, they directed to strew them with cooling herbs, as roses, violets, water-lilies, &c. and to be washed with water and vinegar: than all which, especially the last, nothing more proper can be proposed. I think it not improper likewise to fume houses with vinegar, either alone or together with nitre, by throwing it upon a hot iron or tile; though this be directly contrary to what modern authors mostly advise, which

* Rhazes de re medica, lib. iv. c. 24. & Avicenn. can. med. lib. iv. c. 1.

† Gauderau relation des especes de la peste que reconnoissent les Orientaux.

is to make fumes with hot things, as benzoin, frankincense, storax, &c. from which I see no reason to expect any virtue to destroy the matter of infection, or to keep particular places from a disposition to receive it; which are the only things here to be aimed at. The smoke of sulphur, perhaps, as it abounds with an acid spirit, which is found by experience to be very penetrating, and to have a great power to repress fermentations, may promise some service this way.

As hot fumes appear to be generally useless, so the steams of poisonous minerals ought to be reckoned dangerous: and therefore I cannot but dissuade the use of all fumigations with mercury or arsenic. Much less would I advise, as some have done, the wearing arsenic upon the pit of the stomach as an amulet: since this practice has been often attended with very ill consequences, and is not grounded upon any good authority, but probably derived from an error in mistaking the Arabian word *darfimi*, which signifies cinnamon, for the Latin *de arsenico*, as I have formerly shewn *.

The next thing after the purifying of houses, is to consider by what means particular persons may best defend themselves against contagion: for the certain doing of which, it would be necessary to put the humours of the body into such a state, as not to be alterable by the matter of infection. But since this is no more to be hoped for, than a specific preservative from the small-pox; the most that can be done, will be to keep the body in such order, that it may suffer as little as possible. The first step towards which,

* Mech. account of poisons, essay 3.

is to maintain a good state of health, in which we are always least liable to suffer by any external injuries ; and not to weaken the body by evacuations. The next is, to guard against all dejection of spirits, and immoderate passions : for these we daily observe do expose persons to the more common contagion of the small-pox. These ends will be best answered by living with temperance upon a good generous diet, and by avoiding fastings, watchings, extreme weariness, &c. Another defence is, to use whatever means are proper to keep the blood from inflaming. This, if it does not secure from contracting infection, will at least make the effects of it less violent. The most proper means for this, according to the advice of the Arabian physicians, is the repeated use of acid fruits, as pomegranates, Sevil oranges, lemons, tart apples, &c. ; but above all, of wine-vinegar in small quantities, rendered grateful to the stomach by the infusion of some such ingredients as gentian root, galangal, zedoary, juniper berries, &c. Which medicines by correcting the vinegar, and taking off some ill effects it might otherwise have upon the stomach, will be of good use : but these, and all other hot aromatic drugs, though much recommended by authors, if used alone, are most likely to do hurt by overheating the blood.

I cannot but recommend likewise the use of issues. The properest place for them I take to be the inside of the thigh a little above the knee. Besides, the smoking tobacco, much applauded by some, since it may be put in practice without any great inconvenience, need not, I think, be neglected.

But since none of these methods promise any certain

tain protection; as leaving the place infected is the surest preservative, so the next to it is to avoid, as much as may be, the near approach to the sick, or to such as have but lately recovered. For the greater security herein, it will be adviseable to avoid all crouds of people. Nay, it should be the care of the magistrate to prohibit all unnecessary assemblies; and likewise to oblige all who get over the disease, to confine themselves for some time, before they appear abroad.

The advice to keep at a distance from the sick, is also to be understood of the dead bodies; which should be buried at as great a distance from dwelling-houses, as may be; put deep in the earth; and covered with the exactest care; but not with quick-lime thrown in with them, as has been the manner abroad: for I cannot but think that this, by fermenting with the putrefying humours of the carcases, may give rise to noxious exhalations from the ground. They should likewise be carried out in the night, while they are yet fresh and free from putrefaction: because a carcase not yet beginning to corrupt, if kept from the heat of the day, hardly emits any kind of steam or vapour.

As for those who must of necessity attend the sick, some farther directions should be added for their use. These may be comprehended in two short precepts. One is, not to swallow their spittle while they are about the sick, but rather to spit it out: the other, not so much as to draw in their breath, when they are very near them. The reason for both these appears from what has been said above concerning the manner in which a sound person receives the infection.

tion. But in case it be too difficult constantly to comply with these cautions, washing the mouth frequently with vinegar, and holding to the nostrils a sponge wet with the same, may in some measure supply their place.

This is the sum of what I think most likely to stop the progress of the disease in any place where it shall have got admittance. If some few of these rules refer more particularly to the city of London, with small alteration they may be applied to any other place. It now remains therefore only to lay down some directions to hinder the distemper's spreading from town to town. The best method for which, where it can be done, (for this is not practicable in very great cities), is to cast up a line about the town infected, at a convenient distance; and by placing a guard, to hinder people's passing from it without due regulation, to other towns: but not absolutely to forbid any to withdraw themselves, as was done in France, according to the usual practice abroad; which is an unnecessary severity, not to call it a cruelty. I think it will be enough, if all who desire to pass the line, be permitted to do it, upon condition they first perform quarantine for about twenty days in tents; or other more convenient habitations. But the greatest care must be taken, that none pass without conforming themselves to this order; both by keeping diligent watch, and by punishing, with the utmost severity, any that shall either have done so, or attempt it. And the better to discover such, it will be requisite to oblige all who travel in any part of the country, under the same penalties, to carry with them certificates

certificates either of their coming from places not infected, or of their passing the line by permission.

This I take to be a more effectual method to keep the infection from spreading, than the absolute refusing a passage to people upon any terms. For when men are in such imminent danger of their lives where they are, many, no doubt, if not otherwise allowed to escape, will use endeavours to do it secretly, let the hazard be ever so great. And it can hardly be, but some will succeed in their attempts; as we see it has often happened in France, notwithstanding all their care. But one that gets off thus clandestinely, will be more likely to carry the distemper with him, than twenty, nay, a hundred, that go away under the preceding restrictions; especially because the infection of the place he flies from, will by this management be rendered much more intense. For confining people, and shutting them up together in great numbers, will make the distemper rage with augmented force, even to the increasing it beyond what can be easily imagined: as appears from the account which the learned Gassendus * has given us of a memorable plague, which happened at Digne in Provence, where he lived, in the year 1629. This was so terrible, that in one summer, out of ten thousand inhabitants, it left but fifteen hundred, and of them all but five or six had gone through the disease. And he assigns this, as the principal cause of the great destruction, that the citizens were too closely confined, and not suffered so much as to go to their country-houses. Whereas in another pestilence which broke out in the same place a year and a half after, more

* Notitia ecclesiæ Diniensis,

liberty being allowed, there did not die above one hundred persons.

For these reasons, I think, to allow people with proper cautions to remove from an infected place, is the best means to suppress the contagion, as well as the most humane treatment of the present sufferers : and, under these limitations, the method of investing towns infected, which is certainly the most proper that can be advised, to keep the disease from spreading, will be no inconvenience to the places surrounded. On the contrary, it will rather be useful to them ; since the guard may establish such regulations for the safety of those who shall bring provisions, as shall remove the fears which might otherwise discourage them.

The securing against all apprehensions of this kind, is of so great importance, that in cities too large to be invested, as, for example, this city of London, the magistrates must use all possible diligence to supply this defect, not only by setting up barriers without their city, but by making it in the most particular manner their care to appoint such orders to be observed at them, as they shall judge will be most satisfactory to the country about. Though liberty ought to be given to the people, yet no sort of goods must by any means be suffered to be carried over the line which are made of materials retentive of infection. For in the present case, when infection has seized any part of a country, much greater care ought to be taken, that no seeds of the contagion be conveyed about, than when the distemper is at a great distance : because a bale of goods, which shall have imbibed the contagious aura when packed up in Turkey, or any remote

remote parts, when unpacked here, may chance to meet with so healthful a temperament of our air, that it shall not do much hurt. But when the air of any one of our towns shall be so corrupted, as to maintain and spread the pestilence in it, there will be little reason to believe, that the air of the rest of the country is in a much better state.

For the same reason quarantines should more strictly be enjoined, when the plague is in a bordering kingdom, than when it is more remote.

The advice here given with respect to goods, is not only abundantly confirmed from the proofs I have given above, that goods have a power of spreading contagion to distant places; but might be farther illustrated by many instances of ill effects from the neglect of this caution in times of the plague. I shall mention two, which happened among us during the last plague. I have had occasion already to observe, that the plague was in Poole. It was carried to that place by some goods contained in a pedlar's pack. The plague was likewise at Eham in the Peak of Derbyshire, being brought thither by means of a box sent from London to a tailor in that village, containing some materials relating to his trade. There being several incidents in this latter instance, that will not only serve to establish in particular the precepts I have been giving in relation to goods, but likewise all the rest of the directions that have been set down for stopping the progress of the plague from one town to another; I shall finish this chapter with a particular relation of what passed in that place. A servant, who first opened the foresaid box, complaining that the goods were damp, was ordered to dry them at the fire;

but in doing it was seized with the plague, and died: the same misfortune extended itself to all the rest of the family, except the tailor's wife, who alone survived. From hence the distemper spread about, and destroyed in that village, and the rest of the parish, though a small one, between two and three hundred persons. But, notwithstanding this so great violence of the disease, it was restrained from reaching beyond that parish by the care of the rector; from whose son, and another worthy gentleman, I have the relation. This clergyman advised, that the sick should be removed into huts or barracks built upon the common; and procuring, by the interest of the then Earl of Devonshire, that the people should be well furnished with provisions, he took effectual care, that no one should go out of the parish: and by this means he protected his neighbours from infection with complete success.

I have now gone through the chief branches of preservation against the plague, and shall conclude with some general directions concerning the cure.

C H A P. III.

Of the cure of the plague.

IT appears, from what has been said in the beginning of this discourse, that the plague and the small-pox are diseases which bear a great similitude to each other; both being contagious fevers from Africa, and both attended with certain eruptions. And as the eruptions or pustules in the small-pox are of two kinds, which has caused the distemper to be divided

vided into two species, the distinct and confluent; so we have shewn two sorts of eruptions or tumours likewise to attend the plague. In the first and mildest kind of the small-pox the pustules rise high above the surface of the skin, and contain a digested pus: but in the other, the pustules lie flat, and are filled with an indigested sanies. The two kinds of critical tumours in the plague are yet more different. In the most favourable case the morbid matter is thrown upon some of the softest glands near the surface of the body, as upon the inguinal, axillary, parotid, or maxillary glands: the first appearance of which is a small induration, great heat, redness, and sharp pain near those glands. These tumours, if the patient recover, like the pustules of the distinct small-pox, come to a just suppuration, and thereby discharge the disease. In worse cases of the distemper, either instead of these tumours, or together with them, carbuncles are raised. The first appearance of them is a very small indurated tumour, not situate near any of the forementioned glands, with a dusky redness, violent heat, vast pain, and a blackish spot in the middle of the tumour. This spot is the beginning of a gangrene, which spreads itself more and more as the tumour increases.

But, besides the agreement in these critical discharges, the two distempers have yet a more manifest likeness in those livid and black spots, which are frequent in the plague, and the signs of speedy death: for the same are sometimes found to attend the small-pox with as fatal a consequence; nay, I have seen cases, when almost every pustule has taken this appearance. Moreover, in both diseases, when emi-

nently malignant, blood is sometimes voided by the mouth, by urine, or the like *. And we may farther add, that in both death is usually caused by mortifications in the viscera. This has constantly been found in the plague by the physicians in France; and I am convinced, from accounts I have by me, of the dissection of a great many who had died of the small pox, that it is the same in that distemper.

This analogy between the two diseases, not only shews us, that we cannot expect to cure the plague any more than the small-pox, by antidotes and specific medicines; but will likewise direct us in the cure of the distemper, with which we are less acquainted, by the methods found useful in the other disease, which is more familiar to us.

In short, as in the small-pox, the chief part of the management consists in clearing the primæ viæ in the beginning; in regulating the fever; and in promoting the natural discharges: so in the plague the same indications will have place. The great difference lies in this, that in the plague the fever is often much more acute than in the other distemper; the stomach and bowels are sometimes inflamed; and the eruptions require external applications, which to the pustules of the small-pox are not necessary.

When the fever is very acute, a cool regimen commonly so beneficial in the small-pox, is here still more necessary. But whenever the pulse is languid, and the heat not excessive, moderate cordials must be used.

The disposition of the stomach and bowels to be

* Vid. observ. et reflex. sur la peste de Marseilles, p. 333.

inflamed,

inflamed, makes vomiting not so generally safe in the plague as in the small-pox. The most gentle emetics ought to be used, none better than ipecacuanha; and great caution must be had, that the stomach or bowels are not inflamed, when they are administered: for if they are, nothing but certain death can be expected from them: otherwise, at the beginning, they will always be useful. Therefore upon the first illness of the patient it must carefully be considered, whether there appear any symptoms of an inflammation having seized these parts: if there are any marks of this, all vomits must be omitted; if not, the stomach ought to be gently moved.

The eruptions, whether glandular tumours, or carbuncles, must not be left to the course of nature, as is done in the small-pox; but all diligence must be used, by external applications, to bring them to suppurate. Both these tumours are to be treated in most respects alike. As soon as either of them appears, fix a cupping-glass to it without scarifying; and when that is removed, apply a suppurative cataplasm, or plaster of warm gums.

If the tumours do not come to suppuration, which the carbuncle seldom or never does; but if a thin ichor or matter exudes through the pores; or if the tumour feel soft to the touch; or lastly, if it has a black crust upon it, then it must be opened by incision, either according to the length of the tumour, or by a crucial section. And if there is any part mortified, as is usual in the carbuncle, it must be scarified. This being done, it will be necessary to stop the bleeding, and dry up the moisture with an actual cautery, dressing the wound afterwards with

dossils, and pledgets spread with the common digestive made with terebinth. cum vitel. ov. and dipped in a mixture of two parts of warmed oil of turpentine, and one part of sp. sal. ammon. or in bals. terebinth. and over all must be put a cataplasma of the-riac. Lond.

The next day the wound ought to be well bathed with a fomentation made of warm aromatic plants, with spirit of wine in it; in order, if possible, to make the wound digest, by which the sloughs will separate. After this the ulcer may be treated as one from an ordinary abscess.

Farther, in the glandular tumours, when they suppurate, we ought not to wait, till the matter has made its way to the outer skin, but to open it as soon as it is risen to any bigness: because these tumours begin deep in the gland, and often mortify, before the suppuration has reached the skin, as the physicians in France have found upon dissecting many dead bodies.

This is the method in which the plague must be treated in following the natural course of the distemper. But the patient in most cases runs so great hazard in this way, notwithstanding the utmost care, that it would be of the greatest service to mankind under this calamity, if some artificial discharge for the corrupted humours could be found out, not liable to so great hazard, as the natural way. To this purpose large bleeding and profuse sweating are recommended to us upon some experience.

Dr Sydenham tried both these evacuations with good success, and has made two very judicious remarks upon them. The first is, that they ought not

not to be attempted unless in the beginning of the sickness, before the natural course of the distemper has long taken place : because otherwise we can only expect to put all into confusion without any advantage. His other observation is, that we cannot expect any prosperous event from either of these evacuations, unless they are very copious ; there being no prospect of surmounting so violent a malignity without bolder methods than must be taken in ordinary cases.

As for bleeding, by some accounts from France, I have been informed, that some of the physicians there have carried this practice so far, as, upon the first day of the distemper, to begin with bleeding about twelve ounces, and then to take away four or five ounces every two hours after. They pretend to extraordinary success from this method, with the assistance only of cooling ptisans, and such like drinks, which they give plentifully at the same time. Such profuse bleeding as this may perhaps not suit with our constitutions so well as with theirs ; for in common cases they use this practice much more freely than we : yet we must draw blood with a more liberal hand than in any other case, if we expect success from it. I shall excuse myself from defining exactly how large a quantity of blood is requisite to be drawn, for want of particular experience : but I think fit to give this admonition, that, in so desperate a case as this, it is more prudent to run some hazard of exceeding, than to let the patient perish for want of due evacuation.

As for sweating, which is the other method proposed, it ought, no doubt, to be continued without intermission full twenty-four hours, as Dr Sydenham advises.

advifes. He is fo particular in his direCTIONS about it, that I need fay little. I fhall only add, that theriaca, and the like folid medicines, being offensive to the ftomach, are not the moft proper fudorifics. I fhould rather commend an infufion in boiling water of Virginia fnake-root, or in want of this, of fome other warm aromatic, with the addition of about a fourth part of aqua theriacalis, and a proper quantity of fyrup of lemons to fweeten it. From which, in illneffes of the fame kind with the gaol-fever, which approaches the neareft to the peftilence, I have feen very good effects.

Whether either of thefe methods of bleeding or of fweating will answer the purpofe intended by them, muft be left to a larger experience to determine; and the trial ought by no means to be neglected, efpecially in thofe cafes which promife but little fuccefs from the natural courfe of the difeafe.

A DISCOURSE on the SMALL-POX and MEASLES.

P R E F A C E.

A Considerable part of this discourse was written by me many years since ; and the whole had been finished and given to the public long ago, would the business of my profession, in which I have been constantly engaged, have allowed me time to do it. However, I flatter myself, that this intermission of the work will in the main turn to the advantage of the reader : because whatever inconveniencies may attend age, they are for the most part amply compensated by daily acquisitions of knowledge and experience. Wherefore, without farther apology, I shall now briefly lay down the motives which first induced me to write on this subject.

In the year 1717 the learned Dr Freind published the first and third books of Hippocrates's epidemics, illustrated with nine commentaries concerning fevers. Of these the seventh treats of purging in the putrid fever, which follows upon the confluent small-pox ; and, in support of his opinion, he has annexed to it the letters of four physicians to himself on that subject ; one of which is mine. For after having been several years one of the physicians to St Thomas's hospital, in the year 1708, I observed, that some of my patients recovered from a very malignant sort of small-pox, even beyond expectation, by a looseness seizing them on the ninth or tenth day of the disease, and

and sometimes earlier. Hence I took the hint, to try what good might be done by opening the body with a gentle purge on the decline of the distemper, especially where the patient had constantly been costive from the beginning; which is far from being an uncommon case. The success was in a great measure answerable to my wishes: for, by this method, I recovered many who were in the most imminent danger.

At that time, and indeed during the remainder of his life, I was strictly joined in friendship with Dr Freind; and as we frequently conversed on the business of our profession, I explained this point of practice to him, and met with his approbation. Soon after this, he was called to a consultation with two other eminent physicians, on the case of a young nobleman, who lay dangerously ill of the small-pox: whereupon he proposed my method. But they obstinately opposed it until the fourteenth day from the eruption, when the case appearing quite desperate by convulsions with a lethargy coming on apace, they consented to give him a gentle laxative draught; which had a very good effect. Hereupon Dr Freind gave his opinion to repeat it; but that was over-ruled, and the patient died the seventh day after. The doctor himself has given an ample account of this case *.

This affair soon made so great a noise, that even the gentlemen of the faculty were divided upon it; some commending, others finding fault with Dr Freind's advice: which so essentially affected his reputation, that he thought himself under a necessity of

* Freindi opera, p. 263.

vindicating it : and therefore he entreated me to send him the purport of our former conversation in writing. Such was our friendship, that I soon complied with his request ; and he shewed my letter to Dr Radcliffe, (who at that time was very deservedly at the head of his profession, upon account of his great medical penetration and experience, and had honoured me with a considerable share of intimacy), and told him withal, that he intended to publish his defence. Whereupon Dr Radcliffe obtained leave of me for Dr Freind to annex my letter to his book. But after two or three sheets had been printed off, he was prevailed on by some friends to drop his undertaking : and thus both his work and my letter lay by for some years, that is, until he published his commentaries on fevers. While he was employed in this work, he had fresh thoughts of printing the aforesaid letter with it ; for which purpose I revised and enlarged the letter, translated it from the original English into Latin, and, in short, new-modelled it into the form in which it appears in that book.

It very rarely happens, that a new method of cure in any disease gives universal satisfaction : however, not only Dr Freind and myself invariably persisted in this from the first time I mentioned it to him ; but several physicians likewise, both in town and country, to whom we imparted it, found its salutary effects. But there never are wanting some men of so invidious a turn of mind, that their principal pleasure consists in blackening the reputation, and decrying the productions of others ; as if what they strip their neighbours of, was to be added to their own characters. Thus Dr Freind's book had no sooner appeared in public,
but

but some of this stamp flew to arms, as if to save the commonwealth. In front of this band stood forth Dr John Woodward, physick-professor at Gresham-college, a man equally ill-bred, vain, and ill-natured, who, after being for some time apprentice to a linen-draper, took it into his head to make a collection of shells and fossils, in order to pass upon the world for a philosopher; thence having got admission into a physician's family, at length, by dint of interest, obtained a doctor's degree. This man published a book, entitled, *The state of physick and diseases* *, wherein he took great liberties with Dr Freind, and those in the same sentiment with him, but pointed his arrows most particularly at me; and these were neither arguments nor experiments, of which he had none, but barefaced calumny and raillery, which he poured forth in abundance. It is much against my will, that I thus revive the remembrance of that libel, which already is well nigh sunk into oblivion; and for which the author has been justly exposed by Dr Freind: nor should I have wasted paper on this insignificant story, had not the arrogance and vanity of the man extorted it from me. And, in fine, if I have dwelt longer on this whole affair than might be expected, my motives were, first, to explain who was the author of this method of practice, and then, how little foundation Dr Woodward had for his personal reflections and brawling.

Now, as to what concerns this discourse, I must inform the public, that I have preferred perspicuity to flowers of language, by delivering every precept in as few words as to me seemed consistent with a clear

* London, 1718, 8vo.

conveyance of my notions : and I have added some particular rules and cautions relating to cathartics, for the sake of young physicians chiefly ; who are often disposed too rashly to attempt, and too eagerly to embrace every novelty in practice, especially when handed down to them from persons of whom they have a high opinion. For nothing can be so universally useful, as not to be liable to some exception ; and it is sometimes as great a mark of sound judgment, not to do mischief, as to do good *. Wherefore, not only in this case, but in all others within the compass of our art, the physician ought constantly to remember that of the poet †,

Nothing does good, but what may also hurt.

When I had finished this small work, I thought it might be no less agreeable than useful to the gentlemen of the faculty, if to it I annexed Rhazes's treatise of the small-pox and measles, faithfully translated from the original Arabic into Latin : as it contains an ample detail of many things relating to the nature and cure of these diseases, which, making proper allowances for time and place, coincide pretty much with the doctrines I have laid down. And indeed, it has given me no small pleasure, to see my sentiments confirmed by the greatest physician of the age he lived in. But I have often wondered how it came to pass, that this book had never before been published either in Arabic, or in Latin from the Arabic. Robert Stephens was the first who published it in Greek, at the end of his edition of Alexander Trallian's work in the

* Hippocrates in his first book of epidemics.

† Ovid. trist. lib. ii. ver. 266.

year 1548 *. The Greek copy has been translated into Latin by three several persons ; the first of whom was Georgius Valla of Placentia, whose version was published at Venice, A. D. 1498, and went through several editions. This was followed by a second, done by Johannes Guinterius of Andernac, printed at Strasbourg in 1549 : and Nicolaus Macchellus, a physician of Modena, put forth a third, printed at Venice, in 1555, and again, in 1586 †. Now, the Greek copy was not translated directly from the Arabic, but from a Syriac version, which latter seems to have been done for the use of the common people ; and upon comparing the Greek with this Latin translation from the Arabic, which I now publish, it will appear very inaccurate, by the entire omission of some things, and faulty rendering of others ; whether through the insufficiency, or negligence of the Syriac or Greek translator, I shall not determine. But the manner how I acquired my copy is this.

After having caused a diligent search to be made in our public libraries for an Arabic copy of this treatise to no purpose, I wrote to my good friend the celebrated Dr Boerhaave, professor of physic in the university of Leyden, entreating him to inform me, if such an one could be found in the public library there, which I knew to be very rich in Arabic manuscripts. A copy was accordingly found, which he got transcribed by the Arabic professor, and kindly sent it over to me ; but it proved to be full of faults. This, however, I gave at two separate times to two gentlemen of character, to put it into Latin. One was So-

* The Greek title is, *Παζὴ λόγος περὶ λοιμικῆς*.

† Vid. Fabricii bibl. Græc. vol. xii. p. 692.

lomon Negri, a native of Damascus, extremely well versed in all the oriental tongues; the other John Gagnier, Arabic reader at Oxford: and they both performed the task with great diligence. But upon comparing the two versions I observed that they differed in several places, not in the diction only, but even in the sense: wherefore, as I have no knowledge of the Arabic tongue, I could not determine which of the two to prefer. This uncertainty made me apply to my worthy friend, the Reverend Dr Thomas Hunt, for several years past Arabic professor in the university of Oxford, and lately made Hebrew professor likewise, who, among his many eminent qualities, is universally esteemed a great master of the eastern languages. This gentleman, at my request, generously undertook the province of strictly collating the two Latin versions above mentioned with the Arabic copy, in my presence; and out of them he compiled this, which I now give to the public; and doubtless he would have made it much better, had the Arabic copy been more correct.

London, Sept. 29.

1747.

A DISCOURSE on the SMALL-POX and MEASLES.

C H A P. I.

Of the origin of the small-pox.

BEfore I enter on the medical part of my subject, I shall briefly inquire into the origin of the small-pox, and the manner of its propagation from those countries where it first appeared, almost over the whole face of the earth, as far as I can trace it in history : for these points once settled will throw a considerable light on the nature of the distemper, and the methods of cure, which I shall propose in the sequel of the discourse.

That this is a modern disease, whereby I mean, that it was not known to the ancient Greek and Roman physicians, is to me a matter beyond all doubt. For I think they are widely mistaken who endeavour to prove, that the anthrax, epinyctis, and such like eruptions on the skin, were our small pox : because it is more than probable, that the ancient physicians, who were extremely diligent in the description and distinctive characteristics of all diseases, would not have been content with barely mentioning this, which is so contagious, and makes such dreadful havock among mankind ; but would have minutely described it, had they been acquainted with it.

Wherefore we must have recourse to the writings of the Arabian physicians for the first notices of this disease. The chief of these was Rhazes, who lived
about

about the year of Christ 900. We have a large volume of this great man, published under the title of his *Continent*, a treasure of physic, which seems to have been compiled from his common-place book. In this he informs us, that a physician, whose name was Aaron, (who wrote thirty books of physic), had treated of the diagnostics, the various kinds, and the method of cure of the small-pox *. Now, this Aaron was born at Alexandria, and in the reign of Mohammed practised about the year 622 †. Whence the learned Dr Freind conjectured, that possibly the small-pox took its rise in Egypt ‡. But the origin of the disease is carried farther back than the time of this Aaron, by Dr John James Reiske, who says that he read the following words in an old Arabic manuscript of the public library at Leyden: " This year, in fine, the small-pox and measles made their first appearance in Arabia ||." By this year he means that of the birth of Mohammed, which was the year of Christ 572.

Now, upon mature consideration of the whole affair, I am inclined to think that there are certain diseases, which are originally engendered and propagated in certain countries, as in their native soil. These by Hippocrates are called diseases of the country †; and some of them, sprung up in various parts of Europe and Asia, from peculiar defects in the air, soil, and waters, he has most accurately described +: but the more modern Greeks call them *endemic diseases* ++.

* Contin. 419. 2. † Vid. Abulpharajii hist. dynast. p. 99.

‡ Oper. p. 330. || Hoc demum anno comparuerunt primum in terris Arabum variolæ & morbilli. Disp. inaug. Lug. Bat. 1746.

+ Νεογενεα ἐπὶ τοῦ αἵματος. + Lib. de aëre, aquis, & locis.

++ Ἐνδημικαί. Vid. Galen. com. i. in epidem. Hip.

These, in my opinion, always existed in their respective native places, as proceeding from the same natural causes perpetually exerting themselves.

It is found by experience, that some of these are contagious, and that the contagion is frequently propagated to very remote countries by means suitable to the nature of this or that disease. For some not only communicate the infection by immediate contact of the sound with the morbid body, but have such force, that they spread their pernicious seeds by emitting very subtile particles; which lighting on soft spongy substances, such as cotton, wool, raw-silk, and cloathing, penetrate into them, and there remain pent up for a considerable time: in the same manner as I have elsewhere accounted for the wide progress of the plague from Africa its original country*. Others, on the contrary, are infectious by contact alone. Wherefore the first sort may be spread by commerce, but the latter by cohabitation only.

Of this kind is the venereal disease; which, according to historians of the most undoubted credit, is a native of some of the American islands, especially Hispaniola, and was brought over into Spain near the end of the fifteenth century: thence, in the year 1495, it was carried to Naples, during the war between Ferdinand of Arragon and the French, by some Spanish troops, who had contracted it in the aforesaid island. For these and the French soldiers having at different times had communication with the same women, according as the same towns alternately fell into the hands of the two contending parties; this filthy disease first spread itself over the two armies,

* Discourse on the plague, part i. chap. i.

thence made its way into Italy, and has since infected most parts of the habitable world *.

And I very well remember, that a certain English merchant, who had resided many years in Muscovy, assured me, that the venereal disease was hardly known in that country before the reign of the late Czar Peter the Great : because till that time the traffic carried on by the Muscovites did not require much communication or dealing with foreigners. But after that emperour had taken the resolution of visiting other parts of Europe, and had sent many of his subjects abroad to learn trades and manufactures ; these carried back with them the dire effects of their unlawful lust into their native country ; which raged there with the greater severity, as inflammations and ulcers are the more difficult to be cured in cold climates.

But to return to the small-pox : I really take this disease to be a plague of its own kind, which was originally bred in Africa, and more especially in Æthiopia, as the heat is excessive there ; and thence, like the true plague, was brought into Arabia and Egypt after the manner above mentioned.

Now, if any one should wonder why this contagion was so long confined to its native soil, without spreading into distant countries : I pray him to consider, that foreign commerce was much more sparingly carried on in ancient times, than in our days, especially between mediterranean nations ; and likewise, that the ancients seldom or never undertook long voyages by sea, as we do. And Ludolfus observes that the Ethiopians in particular were ignorant of

* Vid. Astruc de morbis venereis, lib. i. cap. 10. 11.
mercantile

mercantile affairs *. Therefore, when in process of time the mutual intercourse of different nations became more frequent by wars, trade, and other causes; this contagious disease was spread far and wide. But towards the end of the eleventh century, and in the beginning of the twelfth, it gained vast ground, by means of the wars waged by a confederacy of the Christian powers against the Saracens, for the recovery of the Holy Land; this being the only visible recompense of their religious expeditions, which they brought back to their respective countries. From that time forward, wheresoever this most infectious distemper once got a footing, there it has obstinately held uninterrupted possession. For the purulent matter, which runs out of the pustules, being caught in the bed-cloaths and wearing apparel of the sick, and there, drying, and remaining invisible, becomes a nursery of the disease, which soon breaks forth on those who happen to come in contact with it; especially, if the season of the year, and state of the air, be favourable to its action.

In this place, it may not be improper, in confirmation of the foregoing doctrine, to relate the following fact, which was attested to me by a gentleman of great experience, who had been for many years governor of Fort St George in the East Indies. While he was in that post, a Dutch ship put into the Cape of Good Hope, some of the crew of which had had the small-pox in the voyage thither. The natives of that country, who are called *Hottentots*, are so wild and stupid, that they might seem to be of a middle species between men and brutes; and it is their cu-

* Hist. *Æthiop.* lib. iv. cap. 7.

from to do all servile offices for the sailors who land there. Now, it happened, that some of these miserable wretches were employed in washing the linen and cloaths of those men who had had the distemper : whereupon they were seized with it, and it raged among them with such violence, that most of them perished under it. But as soon as fatal experience had convinced this ignorant people, that the disease was spread by contagion, it appeared, that they had natural sagacity enough to defend themselves. For they contrived to draw lines round the infected part of their country, which were so strictly guarded, that, if any person attempted to break through them, in order to fly from the infection, he was immediately shot dead. Now, this fact seems the more remarkable, as it evinces, that necessity compelled a people of the most gross ignorance and stupidity to take the same measure, which a chain of reasoning led us formerly to propose, in order to stop the progress of the plague * ; and which, some time after, had a happy effect, not only in checking, but even entirely extinguishing that dreadful calamity in France, where it broke forth, and threatened the rest of Europe with destruction.

C H A P. II.

Of the nature and sorts of the small-pox.

HAVING sufficiently proved, in the preceding chapter, that the small-pox is a disease of the pestilential tribe ; in order to a clearer knowledge of its

* Discourse on the plague, part ii. chap. 2.

nature, I will briefly premise my notions of pestilence.

All fevers which attack the whole body, may be conveniently ranged under the three general heads of simple, putrid, and pestilential.

Simple fevers arise from a long-continued excess of velocity in the motion of the blood, and its consequences, a disturbance of its due mixture, and an interruption of the secretion of the humours in the several parts of the body.

Putrid fevers are caused, when, together with a concurrence of these circumstances, a lentor ensues in the capillary blood-vessels; and as this fizy blood is gradually pushed forward by the force of the circulation into the veins, it there becomes putrid, and impregnates the rest of the mass with a malignant quality, which is communicated both to the internal and external parts of the body.

Pestilential fevers, in fine, I call all those which are accompanied with some sort of poison. Now, of whatever nature this happen to be, it not only infects and corrupts the blood, but more particularly seizes on the subtile nervous liquor, which is called the animal spirits. Hence it is, that these fevers act with greater rapidity and violence, and are much more fatal than the other sorts. But this one circumstance is common to all fevers, that nature endeavours to conquer the disease, by raising some struggle or other, in order to throw forth from the body whatever is prejudicial to life.

Now, whereas the word *nature* is made use of by physicians in the cure of all diseases, I will here, once for all, plainly declare my sentiments of what we

we ought to understand by that word. That there is something within us, which perceives, thinks, and reasons, is manifest beyond contradiction; and yet the nature of that something cannot be fully and perfectly comprehended in this life. Wherefore I shall resign the disquisition of this point to those, who, while they know too little of, and care less for things falling under their senses, take great pleasure in investigating those things which human reason is incapable of conceiving. However, thus far the soundest philosophers agree concerning it, that it is somewhat incorporeal. For, how can sluggish matter, which is of itself void of all motion, be the source and first cause of thought, the most excellent of all motions? Wherefore, it is sufficiently evident, that this first mover within us is a spirit of some kind or other, entirely different and separable from terrestrial matter, and yet most intimately united with our body.

Moreover, to me it seems probable, that this active principle is not of the same sort in all; that the almighty Creator has endowed man with one sort, and brutes with another: that the former so far partakes of a divine nature, as to be able to exist and think after its separation from the body; but that the latter is of such an inferior order, as to perish with the body. The former was by some of the ancients called *animus*, the latter *anima* *; and they believed, that they were both ingendered in our spe-

* Juv. sat. xv. 148.

Mundi

Principio indulget communis conditor illis

Tantum animam, nobis animum quoque.

Vide etiam Davissii not. ad Ciceron. Tusc. disput. lib. i. cap. 10.

cies : but this I take to be an erroneous position. For as their *anima* suffices for the functions of life in brutes, so our *animus* stands not in need of such an assistant. Now, this matter, if I am not mistaken, stands thus : such is the composition of our fabric, that, when any thing pernicious has got footing within the body, the governing mind gives such an impulse to those instruments of motion, the animal spirits, as to raise those commotions in the blood and humours, which may relieve the whole frame from the danger in which it is involved. And this is done in so sudden a manner, that it should seem to be the effect of instinct, rather than voluntary motion ; though it be effected in us at the command of the *animus*, and in brutes by the power of the *anima*. And indeed, those very motions which are commonly called natural and vital, as those of the heart, lungs, and intestines, which persevere through the whole course of life, even when the will cannot be concerned in them ; as they have their beginning from the mind, so they are perpetually under its direction. I could easily bring many arguments in confirmation of these sentiments, but they would be superfluous in this place. Besides that I am happily anticipated by the learned and ingenious Dr Porterfield, fellow of the royal college of physicians at Edinburgh, who, in a curious dissertation published some years since *, has treated this subject with such perspicuity, that there can be no room left for doubt.

But from philosophy I return to medicine. Our sagacious Sydenham was so far of this opinion, as to

* Vid. medical essays published at Edinburgh, vol. iii. essay xii. and vol. iv. essay xiv.

assert, that a disease is nothing else but an effort of nature to throw off the morbid matter, for the health of the patient *. And Hippocrates, in his usual manner, laconically expressed the same thing thus : “ Nature is the curer of diseases †.” Now, this I have observed more particularly in pestilential fevers, in which the violence of the distemper breaks forth on the skin in the form of pustules, carbuncles, and buboes ; all which are the very venom of the disease, as the common experiment of giving the small-pox by inoculation plainly demonstrates. Thus having made it appear, that the small-pox is an invenomed fever, I come to explain its different sorts ; for as to its history, I refer to Dr Sydenham, who was the first that divided its whole course into certain stages, and gave the method of cure in each.

Most authors divide the small-pox into the distinct and confluent sorts, and estimate both sorts by the size, number, and manner of eruption of the pustules. But in the prognostic, they make so wide a difference between them, that they pronounce the former sort to be almost void of all danger, but the latter always dreadful in its consequences. Thus much indeed is most certain, that the confluent sort are, generally speaking, much worse than the distinct, and that many more die of those than of these. But yet it sometimes happens, that a distinct sort may prove more dangerous than the common confluent sort. Moreover, there are many symptoms extremely dangerous, which are peculiar to the distinct kind, as I

* Observation. medic. circa morborum acutorum historiam, at the beginning. † Νύκτωρ φύσις ἰστέροι. Epidem. lib. vi.

shall shew anon. For the danger does not so much arise from the quantity of the purulent matter, as from other circumstances, which shall be explained in their due place.

Wherefore, in my opinion, the small-pox may more accurately, and agreeably to the nature of the disease, be divided into simple and malignant.

I call simple all that sort, in which the eruption is attended with a slight fever of short duration, the pustules fill kindly, make good matter in a few days, and, in fine, fall off in dry scabs.

The malignant sort is that, in which the eruption appears with a malignant fever, the pustules hardly come to any tolerable degree of maturity, and either suppurate not at all, or if they do in some measure, as the fever is never off, it is with great trouble that they at length end in little crusts.

That malignity appears in such various forms, according to the different nature of the pustules, that its characteristic signs have given various appellations to the small-pox : whereof the chief differences, which have fallen under my observation, are these that follow. For the pustules are either crystalline, warty, or bloody. I am well aware, that authors have run into a greater number of subdivisions ; but I look on the rest to be either a combination of some or all of these, or only different degrees of the same kind : a thing which frequently happens in an irregular disease.

I call those pustules crystalline, which, instead of thick, well-digested matter, contain nothing but a thin, pale water, and are in some measure pellucid.

And

And this sort is sometimes observed, not only in the confluent, but also in the distinct small pox.

They are called warty, when the pustules contain no fluid, but grow hard and prominent above the skin in the manner of warts. These are peculiar to the distinct sort.

The bloody pustules are produced more ways than one. For I have seen cases, where, at the very beginning of the disease, the pustules were so many small tubercles full of blackish blood, resembling those raised on the skin when pinched with a forceps. And these were followed by an intermixture of purple and livid spots, such as physicians describe in the true plague. But it more frequently happens, that pustules coming out very thick, on the third or fourth day after, when they ought to fill, become livid, and a little bloody, with black spots spread over the whole body; which forebode death in a day or two, because they are real gangrenes. It very often falls out at this time, that a thin blood flows not only out of the patient's mouth, nose, and eyes, but also by every outlet of the body; but more especially by the urinary passages, through which it likewise issues sometimes on the first days of the distemper. These are manifestly of the confluent sort.

To these Dr Freind * has added a fourth kind of small-pox, which he calls *siliquose*, in which the pustules resemble little round, soft, hollow bladders, and contain no fluid. But this I place among the crystalline sort; the only difference between them being, that in this case one part of the fluid, which had been thrown into the pustules, flies off through

* Epist. de quibusdam variolarum generibus.

the skin, and the other is absorbed by the lymphatics back into the body.

It is always a difficult task, and sometimes a needless one, to investigate the true causes of things. But as the public may perhaps expect, that I should account for the above-mentioned differences in this disease; I shall say, that the principal reasons of these differences, which have occurred to me upon mature consideration, are, the almost infinite variety of temperaments in various individuals; the seasons of the year and their changes, and in fine, many accidents which befall the body, between the time of catching the infection and the appearance of the disease. For inoculation shews, that the small-pox does not break forth before the eighth or ninth day from receiving the infection.

Possibly it may be thought strange, that, in enumerating these causes, I have not mentioned a word of the nature of the infecting particles. But, besides that the knowledge of this is not attainable by us, it seems to have no great influence on the production of this or that particular sort of the distemper. For we frequently observe, in the same family, where one person catches it from another, that some have a favourable, and others a bad sort.

But such is the power of temperaments of body, that they descend to those of the same blood by a sort of hereditary right: whence some diseases are found to be familiar and fatal to certain families.

As to the seasons of the year, we find, by daily experience, that some of them are fitter to produce certain diseases than others; that they are the causes of epidemic fevers; and that those chiefly, in which
some

some fluid is to be thrown off by the skin, are the most remarkably liable to be affected by their changes.

But numberless are the things comprehended in the third article, to wit, all those accidents which happen to the body from the time of taking the infection to the eruption of the pustules. For the poison is far from lying quiet all this while, but is constantly and gradually exerting its malignity, by first corrupting the animal spirits, and then the whole mass of blood and humours. Wherefore, if bodily exercise, diet, or the affections of the mind (which have great power in this case), should happen to make any particular alteration in the fermenting fluids, they may easily occasion various sorts of pustules, possibly in the manner I am going to explain.

The simple small-pox are suppurations made, while the blood is not so far vitiated, but that the derivations of the humours into the proper parts may be effected tolerably well, and the natural functions are not entirely hurt. But in the malignant sort the case is quite different. For the whole mass of humours is corrupted more or less, according to the nature of the disease; and the blood is in such confusion, that the purulent matter cannot be thrown upon the skin. Now, in this case, sometimes a thin fluid is thrown out, which, when watery, makes crystalline pustules; when thick and viscid, warty; and siliquose, in fine, when the fluid has been resorbed by the lymphatics into the blood, and has left the pustules quite empty. Besides, the texture of the blood is too frequently broken to that degree, that it is obstructed, and stagnates in the small vessels: whereupon, the

skin is strewed with black spots, which are so many real gangrenes, and hæmorrhages ensue through all the outlets of the body ; whence this is called the bloody sort. That these horrid symptoms are the effects of an acrid poison, appears plainly ; because the same happen to those who have been bit by the hæmorrhoids, a Lybian serpent, according to Lucan's beautiful description :

A fierce hæmorrhoids struck both his fangs
Deep into Tullus ; a brave valiant youth,
And fond admirer of great Cato's worth.
And as Corycian saffron, when 'tis squeez'd,
Pours forth its yellow juice through all the holes
Of the hard pressing boards ; so from the pores
Of all the parts flow'd ruddy venom'd gore.
His tears were bloody ; nature's passages,
For their own humours, were all fill'd with blood.
His mouth, his nose, chok'd up with filthy clots :
Red sweats transpir'd from all the skin inflam'd.
His body seem'd one universal wound *.

But from these objects of terrour, it is time to pass to those which may afford comfort.

C H A P. III.

Of the methods of cure in the small-pox.

IT is most evident, that all pestilential diseases are accompanied with the highest inflammation of the blood and humours, and therefore they all require emptying and cooling. I begin with the simple small-

* Lib. ix. ver. 806.

pox, and shall afterwards descend to the treatment of the malignant sort in its several varieties.

But in this place it seems proper to clear up two material points. The one regards the management of the sick, and the other, the diet proper for him.

With respect to the first, serious attention should be given both to the season of the year, and to the strength of the patient. For the same things that are done with safety in summer, may be attended with danger in winter; and young lads or robust men easily bear what might destroy infants, or weakly women. But let this be a general rule, to keep the patient in bed during the first days of the distemper, taking care to defend him from the inclemency of the winter by proper means, and to moderate the excessive heat in summer by cool air. But to chill and as it were to freeze up the sick in winter, is not the part of a prudent physician, but that of a fool-hardy empiric, trying experiments at the expense of unhappy people's lives. Wherefore a mean is to be observed herein, by managing the patient in such a manner, as neither to stifle him with heat or cloaths, nor check the eruption and perspiration by cold. However, great care ought to be taken in general, to supply him with pure and cool air, which he may take in plentifully: because a hot air causes difficulty of breathing, checks the secretion of urine, and increases the number of pustules on the internal organs of the body; the consequences whereof we may justly apprehend to be inflammations, and, towards the end of the disease, gangrenes.

With regard to diet, it ought to be very slender, moistening, and cooling; such as oatmeal or barley-gruel,

gruel, &c. Nevertheless, as the food is to be adapted to the several stages of the disease, the best regimen in the beginning is that which will keep the body open, and promote urine. These advantages are obtained by boiling preserved fruits with their food, especially figs, damascene plums, and tamarinds; and giving them subacid liquors for drink; as small beer acidulated with orange or lemon juice; whey turned with apples boiled in the milk, or with wine; emulsions made with barley-water and almonds; Moselle or Rhenish wine plentifully diluted with water; or any other things of this kind.

When this sort of diet did not keep the body open, the Arabian physicians added manna to it; but this they did sparingly, and with caution. "For it is quite necessary," says Avicen, "that the body be open in the beginning*." Which is one of the most important advices that can be given in this disease, if to it be added, that urine must be made plentifully. For there is a wonderful correspondence between the skin and the kidneys; whereby, whatever fluid is wont to be secreted by the cuticular glands, may with great ease be evacuated by the urinary passages. Wherefore it is very proper to draw off as much of the matter of the disease as can be done, by these passages, in order to prevent the overloading of the internal parts.

Now let us pass on to medicines; and, in the first place, blood-letting is necessary. But as dissensions frequently arise on this subject, some rules are to be laid down concerning it.

It is agreed on all hands, that this remedy is not very suitable to the tenderest age. But yet, as the

* De variolis & morbillis.

blood of infants is generally too thick, and too much in quantity for the bulk of the body; and as they are oft-times seized with convulsions, upon the appearance of the disease, some evacuation ought to be made: which may be safely effected by leeches applied to the temples, or behind the ears. Likewise, if blood cannot be drawn from the arm, in most young subjects either of the jugulars may be opened without inconvenience.

That regard is to be had to the patient's strength of what age soever, is manifest to all. But the weakness is seldom so great, as not to bear some loss of blood, unless it be after some extraordinary evacuations. Nor is the pulse to be overmuch depended on in this case: for it often happens, that the thickness of the blood prevents the secretion of the usual quantity of animal spirits in the brain, and that the vital fluid is not propelled from the heart with due force: in which case, by removing the oppression, the patient's strength is observed even to increase with the bleedings.

But in what proportion blood is to be taken away, will be best determined by the vehemence of the disease. Many of our physicians imagine that they have done their duty, when they have ordered one bleeding, and are vastly cautious of opening a vein at all, after the first appearance of the pustules, for fear of checking the eruption. But this is certainly an ill-timed caution: for in youths and adults it is often necessary to draw blood two or three times, only with an intermission of two or three days between each time. And indeed blood-letting is so far from being an obstacle to the eruption of

of the pustules, if the patient be not too weak, that it forwards it considerably : and for the very same reason, that in large abscesses, when there is too great a fulness, and the heat too intense, the suppuration is brought on quicker and better by taking away some blood.

I have often observed, when in the beginning a vast number of small pustules foreboded a disease of the worse kind, that the face of affairs was so remarkably changed upon one or two bleedings, that the pustules increased in size, and diminished in number, (the greatness of the disease thus giving way to the greatness of the remedy), by which means nature acquired sufficient strength to expel the noxious humour. For it is most certainly true, that nature labours at the expulsion of the poison in the most perfect manner, that is, endeavours to make the pustules fill up as much as possible; and for that end she requires every thing to be quiet within the body, and always abhors confusion. And indeed, the reason why the confluent small-pox is worse than the distinct sort, is not, because the matter of the disease is more abundant in the former than in the latter, but because it is not pushed out in a proper manner. For upon a strict examination we generally find, that the greater quantity is discharged in the distinct sort.

Now, to conclude this head, such is the benefit of large and reiterated bleeding, that it is observed to prevent those evils which often attend the disease : as a delirium, convulsions, difficulty of breathing, and the like. For the dissection of dead bodies shews, that the infection is not confined to the external parts of the body, but seizes on the internal parts also.

also. For I myself have seen subjects, in which the lungs, brain, liver, and intestines were thick beset with pustules. Nor have I the least doubt, but that those sudden deaths which sometimes happen towards the end of the disease, when there seemed to be no room left for fear, are occasioned by the efflux of the purulent matter from the bursted pustules on one or other of the nobler parts. Wherefore no fever is attended with more uncertain signs, on which to ground a sure prognostic, than this of which we are treating. Upon the whole, there is no time of the disease, wherein it may not be necessary to draw blood; if the violence of the fever require it, and the patient appear able to bear it. For it is always better to try a doubtful remedy than none.

A frenzy, coming on the fourth day of the eruption, is justly esteemed of very bad omen; insomuch that Dr Freind says, that he never saw a patient recover who had had this symptom *. But I can positively declare, that I have had better fortune; having recovered many who had been seized with a delirium at that time, by drawing blood immediately, and then throwing in a clyster.

After taking away as much blood as is requisite, it is proper to purge the body; which may be done with safety enough, any time before the eruption of the pustules. But the purge must be of the gentle kind; such as the infusion of fenna with manna, or manna alone, especially for children. For no disturbance is to be raised in the body. But first a vomit should be given, if there happens to be any collec-

* Epist. de quibusdam variolarum generibus.

tion of phlegm or bile in the stomach, or the stomach to be loaded with food unseasonably taken.

As soon as it is certain, that the eruption is near at hand, most physicians are of opinion, that it ought to be promoted, by all means. Yet we are to remember, that this is the proper work of nature; and therefore great care should be taken, neither to increase the motion of the blood over-much, nor suffer it to grow languid.

It was a wise saying of Asclepiades, that he made use of the fever for its own cure *: whereby he meant, that the fever is to be regulated in such a manner, that itself may throw off whatever is noxious to the body. Wherefore the true intention in this case, is, to keep the inflammation of the blood within due bounds, and at the same time to assist the expulsion of the morbid matter through the skin. For both which purposes a medicine, which I have experienced to be useful, is a powder composed of two parts of the bezoardic powder, and one part of purified nitre; and sometimes of equal parts of both. An adult may take half a drachm of this powder three or four times in a day, diminishing the quantity for children, in proportion to their age. And if the effervescence of the blood run very high, a proper quantity of spirit of vitriol may be added to the patient's drink. But if there be any heakings or retchings to vomit, they will be removed by draughts containing half an ounce of juice of lemons, with one scruple of salt of wormwood.

Now, concerning those medicines which ease pain, and procure sleep, in this severe disease, these are not

* Cels. lib. iii. cap. iv.

to be used over-hastily : for all anodynes in some measure obstruct the separation of the morbid humour from the blood, unless the pain happens to be excessive : and moreover, if the violence of the fever has raised a delirium, they generally make it worse. Wherefore it is not proper to employ them, until the eruption of the pustules be completed ; but after that narcotics may be administered with safety. Thus it will be right to give the patient a dose of the thebaic tincture, or diacodion, every evening, especially if he be a youth or an adult person ; for these medicines agree not so well with infants. And sometimes, in cases of very great inquietude, the dose is to be repeated in the morning. For the suppuration of the matter stagnating in the pustules, is forwarded by quiet and sleep. But if, towards the end of the disease, the patient happens to be seized with a shortness of breath, or danger of choking from viscid slime, these medicines are to be entirely prohibited. In the mean time, if the patient is costive, which is generally the case, and the fever continues, the body is to be opened with a clyster every second or third day.

It may be needless to observe, that if this method is proper in the distinct small-pox, it will be found more necessary still in the confluent, which is attended with greater fear and danger.

From the simple I now pass to the malignant small-pox, of which I have already established three sorts, to wit, the crystalline, the warty, and the bloody.

Now, this observation holds good in all kinds of the disease, that the more the pustules tend to suppuration, the greater are the hopes of recovery ; and therefore, when that does not go on according to our

wishes, all possible means are to be employed to throw the morbidic humour on the skin ; with which intention every thing is to be done in this case, which we have proposed in treating of the simple sort. But yet each species of the malignant sort requires a peculiar consideration.

Whereas, in the crystalline sort, the water of the pustules can never be brought to a laudable suppuration ; it ought to be carried off by those passages in the body, which are naturally adapted to the secretion of the thinner fluids. Now, I have said above, that there is a great correspondence between the skin and the kidneys. Therefore, while the thinnest parts of this water are made to transpire through the skin, the grosser parts ought to be drawn off through the urinary passages, by diuretic medicines. Of this tribe there is nothing better than nitre, and that may be administered three or four times a-day, in such quantities as may not offend the stomach, to wit, a scruple or half a drachm, dissolved in small wine, which is the only sort that agrees with this disease till towards the end ; when it may be proper to allow the patient a little Canary, (Dr Sydenham's favourite liquor), or any other soft and generous wine to support his strength. But while nitre is thus taken, it will be right to interpose those medicines which cherish the heart, and promote the flux of the humour into the pustules : such as Raleigh's cordial, or the cordial confection ; the bezoardic powder, sometimes with a little saffron ; and the plain spirit of hartshorn. Besides these, on the fifth or sixth day of the eruption, blisters are to be applied between the shoulders, and to the arms and legs : for which purpose, the blistering epithem is
most

most convenient, as its soft consistence enables it to reach the skin between the pustules, and stick to it. For by this discharge of the serosities, the fever, which increases, when there is no farther derivation of humours to the skin, is seasonably prevented.

I know indeed, that most of our physicians apply this remedy earlier, and even on the first days of the disease, in every malignant small-pox: but there is just reason to fear, that the great commotion raised in the blood by the acrimony of the flies might be an obstacle to the due propulsion of the humour into the beginning pustules.

The warty small-pox is more dangerous than the crystalline; because the matter of the disease, being too thick, can neither suppurate, nor pass off by urine. Wherefore it is necessary to use the utmost endeavours to take off the fever, and to provoke sweat, in order to digest the morbid humour, by the cordial medicines aforementioned. And blisters ought to be applied in this case likewise. But the Arabian physicians pronounced this sort of the disease to be always fatal*.

Lastly, that sort which I have called the bloody small pox, requires peculiar attention. Now, in this sort, if there is any room for physic, those medicines bid fairest for success, which, by their stypticity, thicken the blood in some measure, and so check it, that it cannot break through even the smallest arteries. The best of this kind are the Peruvian bark, alum, and that spirit which is called oil of vitriol. Now, these are to be used alternately in this manner. A drachm of the bark may be given every sixth hour;

* See Rhazes's treatise annexed, chap. viii.

and, three hours after, a proper quantity of alum. It will be a very powerful medicine, if thus compounded. Melt three parts of alum on the fire, with one part of that inspissated juice, which is improperly named *dragon's blood*: when the mass is grown cold, reduce it to a powder; a scruple of which, made into a bolus with conserve of red roses, will be a proper dose. The most convenient manner of giving the oil of vitriol, is in the tincture of roses; five or six spoonfuls whereof may be taken several times in the day. And besides, the patient's common drink may be acidulated with it; especially if purple or black spots appear interspersed among the pustules. And this medicine will be of great service, not only in the bloody, but in all the other sorts likewise, accompanied with these spots. This one thing more I will add, that I have experienced the use of blisters to be safe enough in this case, when a delirium requires their application. I have indeed seen some patients recover by this method, who had discharged large quantities of blood by the urinary canal at the time of the eruption of the pustules; but it is worthy of notice, that, in all these, the disease terminated in some considerable evil. For they were tortured, either with boils breaking out in many parts of the body, or with glandular swellings under the ears or armpits, which were not easily brought to suppuration. I likewise remember the case of a young man, one of whose tonsils was destroyed by a gangrenous ulcer which was very troublesome to cure. Thus upon the whole it is manifest, that it is extremely difficult to clear the mass of blood of this poison; and that a perfect recovery is not to be procured without a suppuration,
either

either in its due course of time, or in the last stage of the distemper.

But in every sort of this disease, it is proper to open the body on the decline, that is, on the ninth or tenth day from the eruption; because a putrid fever generally comes on about this time, while the pustules are drying; or upon the subsidence of the swelling of the inflamed skin, where there is no suppuration; which fever cannot be taken off with equal safety by any other means. But gentle cathartics alone are to be employed in this case, such as I have advised before the eruption of the pustules.

This whole affair I formerly explained and illustrated with proper examples, in my letter to Dr Freind*; and that gentleman likewise abundantly confirmed it afterwards, by the authorities of ancient and modern physicians. So that whosoever refuses his assent to this practice, must resolve not to see at noon-day. All fevers have their certain periods; and where the poisonous matter has once infected the humours, the putrid fuel of the disease can hardly be thrown out of the body early enough. And indeed, when this rule is not observed, we daily see the distemper followed immediately by a hectic fever, attended with a cough, spitting of purulent matter, shortness of breath, and other symptoms of the lungs being affected.

But I must observe in this place, that, however beneficial purging may be at this time; yet, if the body happens to be too loose, either from the natural state of the intestines, or by frequent clysters, this

* Vid. Freind commentar. vii. ad Hippocrat. de morbis popularibus. Et epist. de purgantibus in secunda variolarum febre adhibend.

remedy becomes less necessary, or at least may be postponed for some days. For great regard is to be paid to the patient's strength, which the length of the illness has more or less impaired.

Moreover, it is requisite to be very circumspect, whether there be any remains of the purulent matter lurking under the withered skin of the pustules; for this is sometimes so manifestly the case, that though the scabs appear dry and hard; yet, upon some of them breaking here and there, there issues forth very foetid matter. In this circumstance, the body is not to be purged, but rather to be supported by proper diet, until the matter is all come away; which I have seen continue running to the twenty-fourth day of the disease, and yet the patient recovered. I shall never forget the case of a certain young man of a very robust constitution, who had so dreadful a sort of the confluent small-pox, that when the pustules should have ripened, his whole face was become black and dry; and, in short, thoroughly mortified. As the case seemed quite desperate, I ordered incisions to be made to the quick in many places, and fomentations of a decoction of emollient and warm plants, with the addition of camphorated spirit of wine, to be applied to the parts: whereupon there followed a discharge of matter from the incisions of so offensive a smell, that none of the attendants could bear to stay in the room; and having at the same time promoted this discharge by proper digestives, and duly purged him, he at length recovered. But his mangled face bore the lasting marks of the malignity of the distemper, and of the goodness of the cure.

In fine, it will be of use at this time to take away
some

some blood, if the heat be too great, and the patient have strength enough left to bear it.

Whosoever thoroughly considers all the circumstances of this subject, which I have hitherto explained, must justly wonder how the learned Dr Boerhaave could be induced to hope, that some time or other a specific antidote may be found against this contagious poison *; that is, by which it may be so thoroughly destroyed, that though it had been received into the body, it may not produce the disease. But the principles and elements of things are so certain, and so well established by the permanent laws of nature, that whosoever would endeavour to change them, would act like those philosophers by fire, (as they style themselves), who labour hard to transmute the baser metals into gold; and when continual disappointments have convinced them of the vanity of their hopes, actually extract gold out of the purses of the ignorant and credulous, by the fumes of their charcoal.

This one observation I must add, that there is no species of fever, which requires the body to be thoroughly cleared of the remains of the disease, more than this. Wherefore, upon the patient's recovery, blood is to be drawn, if his strength will bear it; and cathartics are to be given several times at proper intervals. After which, the body is to be restored to its former state by a course of milk, especially that of asses, with suitable food, and the air and amusements of the country.

I shall close this long chapter with the account of a very malignant small-pox in a youth of fifteen years

* Aphor. de cognoscendis et curandis morbis, 1390. 1391, & 92.

of age, communicated to me by my son-in-law, the learned and ingenious Dr Wilmot; who, from the fifth day of the disease, attended the patient jointly with Dr Connel.

In the beginning of the fever preceding the eruption, the patient was directed to be let blood, and to take a vomit, and the next morning a gentle purge: the day following, the small-pox flushed out. The pustules were very numerous and small all over the body, looking more like a rank measles than the small-pox. As his fever ran very high, he was ordered draughts of Gascoign's powder with nitre, to be taken every six hours; and to drink plentifully of barley-water acidulated with spirit of vitriol.

On the fourth day of the eruption, as he was very delirious, in order to procure sleep, a paregoric of six drachms of diacodion was given him, which did not produce the effect.

The fifth day there was not the least swelling of the face; his pulse was quick and full, his heat intense, and the delirium not abated. Wherefore he was ordered another bleeding; the nitrose draughts were continued, with the addition of five grains of myrrh to each; as likewise barley-water with spirit of vitriol, and the paregoric as before.

The seventh, the appearance of the disease was still the same, with the addition of an oppression of his breath, and a very troublesome dry cough. Diascordium was added to his nitrose draughts, and he was ordered a solution of gum ammoniac, to be taken, a spoonful at a time, as occasion required; and the paregoric continued.

The eighth, he complained much of a most acute
pain

pain in his head ; his shortness of breath and cough were increased, his pulse low, and there were no signs of suppuration ; nor the least swelling in the face or hands : but the skin of his face looked like a piece of parchment. Blisters were ordered to be laid on his arms and legs, and plasters made of equal parts of the cephalic and blistering plasters, to be wrapt round his feet : likewise draughts containing of mithridate half a drachm, and of volatile salt of amber half a scruple, to be taken every sixth hour ; and a gargle of pectoral decoction, and oxymel of squills.

The tenth, as every thing was grown worse, besides continuing the same medicines, blisters were ordered below the elbows.

The eleventh, his pulse being much lower, and the patient much weaker, a mixture with Raleigh's confection was ordered to be taken often by spoonfuls, and the other cardiacs continued.

On the twelfth, the pulse being scarcely perceptible, and his breath oppressed to the last degree ; when all hopes of success were given up, a fit of coughing, in which he was almost suffocated, brought on a spitting of a limpid, foetid humour, equal in quantity to a salivation raised by mercury. And this flux continued twelve days without any apparent abatement : from thence it gradually diminished for four days, when it stopped entirely.

By the sixteenth day, the disease, together with that discharge, had so far exhausted him, that he was scarce able to turn in his bed : and yet his spirits were so much better, that he could take plentifully of liquid nourishment. Whereby gathering strength, his fever had now the appearance of a hectic only ;
for

for which he was ordered to lose five ounces of blood, to take draughts of lemon juice, and salt of worm-wood, with a little sperma ceti dissolved in them, every four hours, and to drink asses milk every morning.

By this method, with the repetition of bleeding to five ounces two or three times, and now and then purging him gently with rhubarb; together with elixir of vitriol in Bristol water, and the country-air, he in time happily recovered.

In this case we have a most remarkable instance of what I have already said more than once, that is, how solicitous nature always is, at any rate to expel the poisonous matter of this disease out of the body.

C H A P. IV.

Of accidents in the small-pox.

MAny symptoms and circumstances attend the small-pox, which, as they neither commonly occur, nor seem to depend on the nature of the disease, either affright, or perplex the physician. Wherefore it may not be improper to make some remarks concerning them.

Sometimes the patient is seized with convulsions, just before the eruption. But this symptom is more terrifying than dangerous; and in children particularly, those convulsions which frequently come on before the distemper appears, are generally rather a good, than a bad sign. Now, in this case, though it may seem strange, blood-letting is to be carefully avoided;

voided ; but a blister is to be applied to the neck, and to the soles of the feet plasters made of equal parts of the cephalic and blistering plasters : not forgetting at the same time to give those medicines inwardly, which experience has shewn to be antispasmodic. Of these the chief are, wild valerian root, Russian castor, and the spirits and volatile salts, chemically extracted from animals. For it has been frequently observed, that, upon drawing blood in this case, the disease ended fatally. I can assign no other reason for this event, but that those involuntary motions are occasioned by the patient's weakness ; which is so increased by that evacuation, that nature becomes incapable of throwing out the morbid matter upon the skin. But the thing is otherwise in adults, who, if not too weak, ought to lose a moderate quantity of blood, and then be put into the foregoing method.

The disease begins sometimes in a different, and almost contrary manner. For the eruption appears without much fever or pain ; for which reason there seems to be no danger. But that fond security is very frequently ill-grounded. For at the time when the pustules ought to tend to maturity, as if nature were lazy, and not attending to her duty, there is no suppuration made : hence the fever increases, with inquietude of body, anxiety of mind, difficulty of breathing, and a delirium ; which carry off the patient in a few days. In this state, the fever ought rather to be raised than checked ; and therefore warm medicines are to be directed, which promote suppuration, by increasing the motion of the blood, and thinning the humours : such are the Virginian snake-

snake-root, the contrayerva-root, saffron, asa foetida, myrrh, and the like. But above all, blisters must be laid on all the limbs. Such is the necessity of some evacuation or other in this disease, that if the matter of the infection be over-abundant, as it happens in bad cases, nature never fails endeavouring to throw off the load. Thus in adults a spitting comes on upon the first days of the eruption; whereas children, who seldom spit, have a looseness almost through the whole disease. Both these evacuations are of great importance; and therefore, as the looseness is not to be inconsiderately stopped in children; so in adults, if the spitting does not go on to our wishes, it ought to be promoted by medicines, which stimulate the glands of the mouth; especially gargles made of a decoction of mustard seed and pepper, with the addition of oxymel. For in the confluent and malignant small-pox, if this flux does not arise, and even continue to the end of the disease, it is a very bad sign.

Sometimes a suppression of urine makes the patient suffer great pain, receiving little or no relief from diuretics. In this case Dr Sydenham directed, that he should be taken out of bed, and exposed to the cool air: which generally has a good effect. But the most convenient method will be to open the body by a clyster, especially if, the pustules now appearing, there be any fear of taking cold; and then to insist a little on diuretic medicines; for which purpose Glauber's salt is particularly useful, as it is both laxative and diuretic.

Whenever a woman with child is seized with the small-pox, the physician may justly dread the consequences. For he has reason to fear a miscarriage, which

which exposes his patient to two sorts of danger, the one from the new fever, which attends that accident; the other from the loss of blood, which may bring her very low. And therefore the farther she is advanced in her pregnancy, the greater risk she runs; because the delivery of a large child causes a greater flooding than that of a small one. I can however assert from my own knowledge, that a certain woman was delivered of a son at the full time, while she was actually labouring under this disease; and yet both the mother and the child did well; but this is a case equally extraordinary and fortunate. But still a good deal depends on the time of the disease, when the abortion happens: because the weakness occasioned thereby is the more dangerous, the more nearly it coincides with the time of the ripening of the pustules. Wherefore, if the efflux be more than nature usually requires, those medicines are to be given, which I have proposed in the bloody small-pox.

Now, whereas these cases fall out various ways, and physicians have been divided in opinion concerning some of them; it may not be improper to make some animadversions on them separately.

When a woman in the small-pox suffers abortion, the child most commonly comes into the world with the distemper on it; but not always. The reason of this difference will easily be understood, by duly considering what I have already said concerning infection *, and comparing it with what I shall hereafter say concerning the inoculation of the small-pox †. Whereby it will plainly appear, that the seeds of the

* Chap. i. † Chap. v.

disease are subtile particles, exhaled from the pustules come to maturity; which do not produce the effect, till eight or nine days after their entrance into a sound body. Upon which account, when the child comes into the world, before matter is made in the pustules on the mother, it has no visible marks of the distemper. And thus it sometimes happens, that the small-pox, which the infant has contracted in the womb, breaks forth on the second, third, or any other day before the eighth from the delivery, whether the child be come to its full time or not; as will appear by the following case, which lately fell under my own observation.

A lady of quality was, in the seventh month of her pregnancy, seized with so malignant a sort of the confluent small-pox, that there was no appearance of any one favourable symptom. For she neither spit plentifully; nor did the swelling of the hands or feet come on, upon that of the face subsiding; nor, in fine, was she assisted by a flux of urine on the decline of the disease; but, on the contrary, her face was all covered with small pimples, which made little or no matter. In this condition, she was, on the eleventh day of the distemper, pretty easily delivered of a son, who brought no marks of the infection into the world; and she died on the fourteenth day. But in the morning of the fourth day following, the infant was seized with convulsions, the forerunners of the eruption, which appeared the same day, and he died in the evening. In this case it is plain, that some suppuration having been made, as usual, on the eleventh day, the distemper passed from the mother

to the child, which was not to break out till eight days after.

But in case there is no miscarriage, the child will be free from the disease during his whole life ; unless he happens to be born before the pustules were come to maturity. For as something naturally inherent in our constitution renders the body liable to the infection ; so, when this debt is once paid to nature, we are secure ever after. But the infant in the womb sometimes catches the distemper, without the mother being affected ; as I shall prove by this remarkable instance, which I well remember. A certain woman, who had formerly had the small-pox, and was now near her reckoning, attended her husband in the distemper. She went her full time, and was delivered of a dead child. It may be needless to observe, that she did not catch it on this occasion : but the dead body of the infant was a horrid sight, being all over covered with the pustules ; a manifest sign that it died of the disease, before it was brought into the world. Wherefore, upon the whole, let none entertain the least suspicion, that the same person can possibly have this distemper twice. But the reason why the body is liable to the infection once, and no more, is to me as entirely unknown, as to the most ignorant of mankind. But this I will add, that an infant in the womb may have the good luck to go through the disease, and yet the marks be quite effaced before the birth *.

From what we have said concerning abortions, it is easy to comprehend what judgment ought to be formed of the monthly evacuations coinciding with

* Vid. Mauriceau, sur la grossesse & l'accouchement des femmes, obs. 576.

the small-pox, a circumstance at which people are apt to be alarmed. For this evacuation is of the same kind with the flooding which follows upon abortion : and whether it happens at the usual time, or is brought on irregularly by the extraordinary effervescence of the blood ; in both cases, it rather affords relief than threatens danger. However, if in either case the discharge should prove so great, as to weaken the patient over-much ; it must be restrained by those medicines which I have recommended in the bloody small-pox, without neglecting to draw blood, if requisite. But we know by experience, that women have sometimes uterine discharges through the whole course of the disease, without loss of strength, or any other inconvenience.

The same judgment may be formed of hæmorrhages at the nose, which frequently occur in the beginning of the distemper ; for they are occasioned by the rarefaction of the blood in the small vessels ; and therefore, by diminishing the heat, are generally more serviceable than detrimental, unless they run to excess.

It happens sometimes, though not often, that the variolous fever is accompanied with a single or double tertian intermitting fever ; in which case, the Peruvian bark, or, which is more convenient, its extract, is to be given at proper distances of time, till the paroxysms cease to return. Nor is there any reason to fear, that this medicine will hinder the maturation of the pustules : on the contrary, as this new effervescence of the blood, and commotion of the humours, may easily prove an obstacle to the suppuration ; by checking these, all things proceed in their usual course. But first, the body is to be opened by a clyster. Now, the

the case is much the same here with respect to this febrifuge, as in mortifications, in which it is known to be of signal service*: and it was from a reflection, that mortifications are always accompanied with a fever, that I have proposed the same medicine in the bloody small-pox, interspersed with black spots, or, in other words, with small gangrenes†.

Here it may not be improper to lay down one general rule, which is, that whatever acute disease comes upon the small-pox, requires to be treated with its own peculiar medicines, and generally bears them very well.

By this time I hope I have thrown sufficient light on the most material circumstances of this part of my subject. But before I close it, it seems well worthy of notice, that this disease is generally very mild, when it is contracted soon after some considerable evacuation, whether natural or artificial. Thus a woman in childbed has generally a kindly sort of the small-pox; if she has recovered somewhat of strength, by the time she is seized with the distemper; and therefore reaps benefit from her late sufferings. The same thing may be said of such as are newly recovered from some acute disease. And I have formerly seen many patients in the hospital, who, after salivation for the venereal disease, caught the small-pox, while they were yet vastly emaciated; and all of them went through it with great safety; a manifest proof, that any evacuation, by withdrawing fuel from the fire, agrees particularly well with this disease. Lastly, to all that I have hitherto said, this one remark more is

* Vid. medical essays, Edinb. vol. v. part 1. artic. 10.

† Chap. iii.

proper to be added. Though this be naturally a dreadful disease, yet it is sometimes found to produce very good consequences. For in constitutions, where the blood is vitiated, either from an original taint, or by the manner of living; and glandular tumours are occasioned by the viscidty of the lymph; the small-pox, by purifying the juices, contributes to a better state of health for the future.

C H A P. V.

Of the inoculation of the small-pox.

THE custom of inoculating, or transferring the small-pox from an infected person to one that is sound, has prevailed among us for some years. This matter has drawn our physicians into parties; some approving, and others disapproving this new practice. I shall therefore freely interpose my opinion in the case.

Our nature is so formed, that although we are always inclined to avoid whatsoever may be hurtful; yet, when any evil is to be undergone, which can only be suffered once, this we are impatient to go through, even with a certain boldness; with this view, that the remainder of life may be passed without the uneasiness which arises from the continual apprehension of its coming upon us.

It having therefore been found by experience, that nobody was seized with the small-pox a second time, and that scarce one in a thousand escaped having it once; men began to consult how the disease might be communicated; it manifestly appearing to be contagious,

tagious, and it was obvious to conjecture, that the seeds of that contagion lay hidden in the pustules.

But I have often wondered how such a notion could come into the heads of people almost quite ignorant of what relates to physic. For, as far as I have been able to find out by inquiry, this was the invention of the Circassians, the women of which country are said to excel in beauty; upon which account, it is very common, especially among the poorer sort, to sell young girls for slaves to be carried away into the neighbouring parts. When therefore it was observed, that they who were seized with this distemper, were in less danger both of their beauty and their life, the younger they were; they contrived this way of infecting the body, that so the merchandise might bring the greater profit. Neither did the thing require the assistance of a physician or surgeon. It was sufficient to make a small wound in the skin, in any part of the body, and put into it a very little of the matter taken out of the ripe pustules; and this even the women had learned to practise*: in like manner as our artists now, making a very slight incision in each arm, and putting upon it a small thread of lint or cotton, imbibed with the corruption, very rarely frustrate the hopes of their desirous patients.

In process of time, not many years ago, this art began to be used at Constantinople and Smyrna; not by the Turks, who imagining all things in life to come to pass by unavoidable fate, think it impious to oppose and resist it; but among the Grecians, Armenians, and the people of other countries living there,

* See Philosophical Transactions, No 339. and 347.
who

who gave the knowledge of it to our countrymen*.

But that I may omit nothing relating to this affair; a learned † author has given an account, that the practice of sowing this disease, as they call it, has been known to the Chinese above these hundred years; and that they do it in another manner, which is this. They take the skins of some of the dried pustules, which are fallen from the body, and put them into a porcelain bottle, stopping the mouth of it very close with wax. When they have a mind to infect any one, they make up three or four of these skins, putting between them one grain of musk into a tent with cotton, which they put up the nostrils.

It was indeed not difficult for such ingenious people, when they saw those who were conversant with the sick, contract the same infection, to guess that the air, tainted with the foul breath of the diseased person, did, when drawn in, corrupt one who was sound; and therefore they might rationally argue, that the same contagious matter might be taken in at the nostrils. Nor were they mistaken in this point.

It is however certain, (whatsoever the author of this narration, more skilled in theological than in medical learning, may say to the contrary), that this Chinese way of implanting the distemper is attended with much more danger than the Grecian one. For the morbid particles inspired violently offend the brain, by

* See Maitland's account of inoculating the small-pox, London, 1722; et Dissertatio medica de Byzantina variolarum incisione, auctore Le Duc. Lugd. Bat. 1722.

† Vid. Lettres edifiantes & curieuses des missionnaires, recueil xx. page 304.

reason of its nearness to the nerves which perform the office of smelling; and we have in another place proved, that contagion is propagated, not by the blood, but by the nervous liquor *.

I myself have had an opportunity of making an experiment to this purpose. For, when in the year 1721, by order of his Sacred Majesty, both for the sake of his own family, and of his subjects, a trial was to be made upon seven condemned malefactors, whether or not the small-pox could safely be communicated by inoculation; I easily obtained leave to make the Chinese experiment in one of them. There was among those who were chosen out to undergo the operation, a young girl of eighteen years of age: I put into her nostrils a tent, wetted with matter taken out of ripe pustules. The event answered: for she, in like manner with the others, who were infected by incisions made in the skin, fell sick, and recovered; but suffered much more than they did, being, immediately after the poison was received into the nose, miserably tormented with sharp pains in her head, and a fever, which never left her till the eruption of the pustules.

Since that time, this practice has been followed, without much fear, and indeed (as it usually happens in new experiments) sometimes with a degree of rashness; as promising a milder kind of small-pox, than when taken in the natural way. For, by † the accounts

* Introduction to the mechanical account of poisons.

† See Dr Jurin's letter to Dr Cotesworth, containing a comparison between the mortality of the natural small-pox, and that by inoculation; and His account of the success of inoculation in the years 1724, 25, and 26.

collected by those who have inquired into the affair, it is plain, that scarce one in a hundred dies by the inoculated small-pox ; whereas many more in proportion are destroyed by the ordinary disease.

A remarkable instance of this difference, and with what security this transplanting the distemper may be made, is given in the following relation, communicated to me by a gentleman of great credit. He was a merchant at St Christopher's, in the West Indies, and in the making of sugar (which is the trade of that place) employed a great number of slaves. In one year, when the small-pox raged with more than ordinary violence in the neighbouring islands, with his own hands, he inoculated three hundred of them, from five to thirty years of age, with such success, that not one of them died, though most of them were negroes. And whereas all the Americans suffer this distemper in a most terrible manner ; yet experience shews, that it is much more dangerous, when it attacks the natives of Africa.

Things being thus, it may be proper to consider, whether any reasons can be alleged to the contrary. And, in the first place, there are some who insist upon it, that the eruptions produced by inoculation are not the genuine small-pox, and consequently that they cannot secure any one from having the disease hereafter. Moreover, they take pains to bring testimonies of patients, who, after having undergone the artificial distemper, have nevertheless been afterwards seized with the true one.

Now, I own, I cannot understand how contagion, that is, the very seed of the disease, should produce, not its own proper distemper, but another of a quite different

different kind. Neither certainly does it matter, by which way the infection is received, provided it brings forth manifest marks of the disease. And as to those, who, after having been inoculated with success, are, notwithstanding this, said to have suffered the small-pox; I must protest, that, after the most diligent inquiry, I have not been able to find out one convincing proof of this kind. I very well know, that a story is spread abroad, particularly by a late author, of a boy, upon whom, about three years after he had contracted the disease by inoculation, it broke out again. But I am well assured, that this narration is of doubtful credit; and that there were some of the family, who affirmed, that no small-pox appeared upon the inoculation; that the parents (as we easily believe what we wish) deceived themselves, and that the by-standers did not care to take away from them this pleasing mistake.

But to speak plainly, if such a thing happened once, why do we not see it come to pass oftener? Or what can a single example, supposing it to be true and certain, avail, when innumerable experiments have produced nothing like it? However, some men are infected with an incurable itch, of writing, and take great pleasure in contradicting others, to whom they bear envy. Let us therefore give them leave to applaud themselves, and enjoy their own vain-glory.

But they will still go on to terrify us, by saying, that there is danger left, together with the small-pox, some other infectious disease, inherent in the blood and humours of the sick person, should be transmitted into the sound body; all contagion being very
subtile,

subtile, and wonderfully active. And it is indeed not improbable, that some other distemper, besides those which are cutaneous, may, by such a way as this, get admittance into the skin; and such perhaps are scrophulous swellings, and the venereal disease. Yet I can hardly believe, that it ever happens, that the seed of one distemper should bring along with it mixed, the procreative matter of another, of a nature quite different from it. However it be, it would be madness in a physician, without any choice, to take the morbid matter for this purpose, out of sick bodies, without distinction. The most proper subjects are infants or children, sound in all other respects, as far as can be judged, and born of healthy parents. Besides, it is, in my opinion, more material, into what kind of a body the venom be infused, than out of what it be taken. And this I the rather mention, because I have more than once known rash and unwary surgeons to implant the disease into bodies weak, and of an ill habit, with a fatal event. Lastly, it is of very great consequence to take care not to throw a new infection into one already infected: for I have observed this to prove mortal; nature being oppressed and sinking under a double disease, when perhaps she might have got the better of either of them single.

I have often considered for what reasons it is, that the inoculated is safer than the natural small-pox; and the following seem to be the chief. First, the venom is communicated to a young, healthy, and, for the age, strong body. In the next place, the violence of the fever, which follows, is prevented, if there be occasion, by bleeding, and gentle purging. And lastly,

lastly, through the whole time that the contagious matter is exerting its malignity upon the humours (which is generally eight or nine days), quietness, moderation in diet, and every thing else is strictly observed : whereas, many incur the natural distemper on a sudden, when the blood is heated with wine and exercise ; by which means, all the symptoms must necessarily prove more severe and dangerous. Some have also been of opinion, that the discharge out of the wound made to introduce the purulent matter, and likewise from the small pimples which break out round it, may contribute something to the safety of the patient. But the small quantity which runs out this way, cannot, I think, avail much. Two blisters laid, one to an arm, the other to a leg, will certainly do much more ; especially if they be kept running throughout the whole course of the disease. And I make no question, but this practice would be of very great service.

It is proper to mention, that this artificial disease is usually so mild, that it scarce requires any help from medicines. But where it happens otherwise, as it sometimes does, the same will be necessary, which have been directed in the several kinds of the natural small-pox.

To conclude ; it ought not to be omitted, that boils, and swellings under the ears, and in the armpits, arise more frequently after the distemper procured by art, than after that which comes of its own accord ; for this reason, as I suppose, that the venomous matter is pushed forward with less force, which disadvantage nature makes amends for this way.

Therefore, all possible means are to be used to

ripen such tumours, of whatever kind they are: if this cannot be done, they must be opened by incision; and when all the matter is drawn out, the body must be purged by proper medicines, which are to be oftener repeated in this, than in the natural disease.

C H A P. VI.

Of the measles.

THE measles have a great affinity with the small-pox; being originally bred in the same country, propagated in the same manner, by infection, into distant parts of the world, and never seizing any person more than once.

The history of this disease, as it generally appears among us, Dr Sydenham has described with his usual accuracy, calling it a fever, which in its nature and method of cure agrees very much with the small-pox; that is, accompanied with a great inflammation, and in which pustules of a particular kind are thrown out upon the skin.

Now, this inflammation does not only affect the surface of the body, but the inner parts also, and particularly the lungs: hence follows a cough, with a difficulty of breathing. And although the distemper in its nature be less dangerous than the small-pox, and continues a shorter time; for it usually is ended in six or seven days, or, at the-farthest, in eight, very thin, and light scales, like fine flower, falling off from the skin at that time; yet it seizes with more violent heat,

heat, and greater anxiety than the other does. Therefore Rhazes observed, that the inflammation of the whole body, the inquietude, and anxiety of mind, are much more terrible in the measles, than in the small-pox *.

I have therefore often wondered, why that sagacious and experienced physician, whom I have so often mentioned with praise, did not prescribe bleeding in the very beginning of the disease; but neglected this material part of the cure so far, that he only ordered it at the end, when a hot regimen, and too warm medicines, had brought upon the patient a cough and shortness of breath. Especially since he himself takes notice, that the looseness, which often follows this fever, and which, he says, proceeds from hot vapours from the inflamed blood falling upon the bowels, is only to be cured by blood-letting †. But the great man deserves pardon upon this account, that, in those times, physicians never attempted to take away blood in those fevers which were attended with any eruptions, particularly in children, who are the most liable to this kind of illness. Their reason was, lest that emptying of the vessels should hinder the coming out of what was to be discharged by the skin. But daily experience shews, that this fear is vain, and that the event is quite contrary to what they imagined.

To come therefore to the cure: As this pestilential disease is of kin to the small-pox, it requires a management not very different from the same, which we have recommended in that distemper. Blood must be taken away in the beginning, according to the age

* See his book, at the end of this, chap. i.

† De morbillis, cap. v. p. 207. edit. 1685.

and strength of the patient. It is best, if possible, to do this before the eruption of the pustules ; but, if they are already come out, it must however be taken away. For the greatest danger is an inflammation of the lungs, which cannot be prevented too soon. Therefore in the height of the fever also, although bleeding was not neglected in the beginning, yet it is sometimes necessary to repeat it. And in the last place, at the end of the disease, when the skin is now growing dry, and the scales falling off, it will be a great error not to open a vein again ; that, by this means, a flux of humours upon the breast and intestines, and the symptoms of a hectic fever and consumption, may be happily prevented.

It is really a thing to be grieved at, that physicians, in so great an inflammation of the whole surface of the body, should not always have directed this lessening the quantity, and thereby checking the heat of the blood. And I most of all wonder, that Dr Morton, who took notice of the necessity of this practice, when the disease was at the highest, should absolutely forbid it in its first appearance. But this physician's judgment was perverted by a vain, and not rightly understood, opinion of a malignity and venom infecting the animal spirits ; which had so possessed his mind, that he thought of nothing more, than of throwing into the body hot medicines, called cordials, as auxiliary forces against the supposed enemy *. A bad example, and at the same time a convincing proof, how necessary it is, that a man should be instructed in the principles of mechanic philosophy, before he applies himself to the art of physic.

* De febribus inflammatoriis, cap. iv.

The diet ought to be the same as is prescribed in the small-pox ; taking particular care that the body be kept lax, rather than bound up, through the whole course of the distemper.

As to remedies ; to those cooling ones which are directed in the other disease, must be added such as abate the cough, and help expectoration ; particularly oily linctus and the pectoral infusion, of which, with the addition of a little nitre, the patient may drink frequently.

Dr Sydenham gave diacodion, even on the first days of the illness ; but I think he was not cautious enough in this point ; for all medicines of this kind thicken the humours, straiten the breath, and retard the eruption of the pustules. Therefore, during the increase of the distemper, they are to be used very sparingly ; but at the latter end they are of great service : inasmuch as there is then a necessity to quiet the cough, which, from the sharp defluxion upon the lungs, threatens a hectic fever and consumption. But in the mean time, gentle purges are to be given at due intervals. Milk, especially that of asses, must be drank. Change of air is also necessary. And lastly, exercise, suitable to the strength of the patient, is to be daily enjoined.

I am afraid, lest I should seem vainly to court applause by the following narration ; yet it is so much to the purpose, and so happily confirms what I have said, that I must beg leave to relate it. About forty years ago, the measles raged with so great violence in this city, that they proved more fatal than even the small-pox. At that time, a physician of great eminence came to me, desiring that I would inform

him what method I followed in this disease, I asked him, whether or not he used to take away blood? He answering, No, because Sydenham very seldom did it; I advised him to open a vein in the beginning of the distemper, or, if he was called in later, as soon however as he possibly could: for, said I, this disease always brings with it a peripneumony, which he very well knew ever required bleeding. Not long after, he met me again, returning me hearty thanks for my counsel, assuring me, that he had not lost one patient whom he had treated in this manner. Since that time, this practice grew so common, that it is now followed even by our apothecaries.

In the last place, it is proper to take notice, that, as was observed concerning the small-pox *, that the disease is more or less rife, according as the season of the year and state of the air conspire with the infection; so the like happens in the measles. And Dr Morton relates, that, in the year 1672, this distemper was so terrible, that in London there died of it three hundred every week †.

But I have at last finished this little work; which though it may perhaps, to contentious and malevolent persons, give matter for calumny and finding fault; yet will, I hope, prove beneficial to mankind, especially to our own countrymen. This is all I desire; for the consciousness of having done right is beyond all praise, carrying with it its own reward: and this he always enjoys, who consults the public good, and by his actions shews, that he thinks he is

Not for himself, but for the whole world born ‡.

* Chap. ii.
tis, pag. 427.

† Append. ad exer. de morbis acutis.
‡ Non sibi, sed toti genitum se credere mundo. Lucan. l. ii. ver. 383.

RHAZES'S TREATISE on the SMALL-POX and MEASLES.

P R E F A C E.

In the name of God, merciful and gracious.

ABU-BEKER MOHAMMED, the son of Zacharias, saith thus :

On a certain night, at a meeting in the house of a nobleman, of great goodness and virtue, and very fond of the explanation of useful sciences, that they might be made plain and intelligible for the public benefit ; the conversation having turned on the small-pox, I then spoke what came into my mind on that subject, Which when that great man (whom may God long preserve for the good of mankind) had heard, he desired, that I would write a discourse on that disease with sufficient aptness, solidity, and clearness ; because there had never yet been published, either by the ancients or moderns, a satisfactory account of it.

I therefore composed this treatise, hoping to receive my reward from the almighty and glorious God, as the effect of his good-will.

Now, this is the sum of its contents, and the heads of the chapters.

C H A P.

C H A P. I.

Of the causes of the small-pox ; and how it comes to pass, that no mortal, except by chance here and there one, escapes free from this disease.

C H A P. II.

What bodies are most disposed to the small-pox ; also of the seasons of the year, in which they most frequently happen.

C H A P. III.

Of the prognostic signs of the eruption of the small-pox and measles.

C H A P. IV.

Of the regimen or cure of the small pox, in general.

C H A P. V.

Of preservation from the small-pox before the signs of them appear ; and the way to hinder the multiplying of them after the signs have appeared.

C H A P. VI.

Of those things which hasten the eruption of the small-pox : also how nature is to be assisted therein.

C H A P. VII.

Of taking care of the eyes, throat, ears, and joints,
as

as soon as the signs of the small-pox have appeared.

C H A P. VIII.

Of ripening the pustules.

C H A P. IX.

Of drying the pustules.

C H A P. X.

Of taking away the dry scabs of the small-pox, and the eschars from the eyes, and the rest of the body.

C H A P. XI.

Of destroying the marks of the small-pox.

C H A P. XII.

Of the food and diet in the small-pox.

C H A P. XIII.

Of managing the discharges of the belly, in the small-pox.

C H A P. XIV.

Of the curable and incurable small-pox and measles.

RHAZES'S

RHAZES'S TREATISE ON the SMALL-POX and MEASLES.

C H A P. I.

Of the causes of the small-pox; and how it comes to pass, that no mortal, except by chance here and there one, escapes from this disease: also a brief account of what Galen has mentioned concerning it.

AS to those physicians, who affirm, that the most excellent Galen has made no mention of the small-pox, and therefore that he did not know this distemper; surely they have either never read his works at all, or only very cursorily; nay, most of them do not know, whether what he plainly says of it, is to be understood of that disease. For Galen, in a certain treatise, says, this ** does good this and that way, and also against the small-pox. And in the beginning of the fourteenth book, *Of pulses*, that the blood is putrefied in an extraordinary degree, and that the inflammation runs so high, that it burns the skin; so that the small-pox, and pestilent carbuncle, are bred in it, and quite consume it.

And in the ninth treatise of the book *Of the use of the parts*, he observes, that the superfluous parts of aliments, which are not turned into blood, and remain in the members, putrefy, and in time increasing do ferment; whence, at last, are generated the pestilential carbuncle, the small-pox, and confluent inflammations.

Lastly, in the fourth part of his commentary upon

on the Timæus of Plato, he says, that the ancients gave the name *φλεγμονή* to every thing which produces redness, as the carbuncle, and small-pox; and that these diseases are bred in those in whom bile abounds.

But as for those who allege, that he has proposed no remedy or cure, nor explained the nature of this distemper, they indeed say what is true: for he mentions no more than what we have cited. But God knows, whether he might not have done it in some other books, which have not yet appeared in Arabic.

As for my own part, I have with great diligence inquired of those who understand both the Syriac and Greek language, and desired them to inform me concerning this matter: but not one of them could tell me more than what I have set down. But this indeed I very much wonder at, and why he passed over this distemper in silence; especially since it was frequent in his time, and therefore there was great reason for his prescribing remedies against it, as he was so diligent in finding out the causes and cures of diseases.

The moderns have, it is true, proposed some medicines for the cure of the small-pox, but not distinctly and clearly enough; neither has any one of them explained the cause of it, and why, except here and there one, nobody escapes it; nor shewed the methods of cure in a right order. Upon which account, I hope that the good man who encouraged me to undertake this work, will have his recompense; and that my reward will be doubled, when I shall have described whatever is necessary to the cure of this disease in due method, assigning to every thing its proper place, by the help of God.

Wherefore

Wherefore let us begin to recite the efficient cause of this distemper ; and why it happens, that scarcely any one mortal escapes it. And then we will pursue separately, in the subsequent chapters, the other things which relate to it ; and, with God's assistance, shall say on each head whatever is necessary for its cure.

I say then *, that the body of man, from the time of his nativity, till he arrives at old age, continually tends to driness ; and that therefore the blood of infants and children, and, in proportion, the blood of young men, abounds much more with humidity, than the blood of old men, and is also hotter. And this indeed Galen teaches us, in his commentaries upon the aphorisms, where he says, the heat of children is indeed greater in quantity, than the heat of young men ; but the heat of young men is more violent in quality. This also is evident from the force of their natural actions, as the digestion of their food, and accretion in children.

Therefore, the blood of children may be compared to new wine, in which the fermentation leading to ripeness is not yet begun ; and the blood of young men to the same, fermenting and emitting steams, till it is quiet and ripe. And, lastly, the blood of old men is like to wine, whose strength is gone, so that it becomes vapid, and begins to grow sour.

Now, the small-pox arises, when the blood putrefies and ferments, and the fermenting particles are thrown out of it ; the blood of children, like to new wine, being changed to that of young men,

* Here begins the translation of the anonymous Greek interpreter.

which

which is as wine perfectly ripened. And this fermentation and ebullition is the disease.

And this is the reason why children, especially males, rarely escape being seized with it. For, without doubt, as the wine naturally ferments till it comes to perfection; so the blood undergoes the same alteration, in passing from its first to its second state. And there seldom happens a temperament in an infant or child, in which such a change can be made in a small time, and without manifest signs of it: as may be judged from their diet, which in infants is milk; and in children, not milky, but their food is stronger, in proportion, than that of other ages, and more compounded. To which it may be added, that in these there is, after food, a greater motion of the humours. For these reasons, very few children go into life without this distemper. Besides this, great alterations are made here, by different temperaments, manners of life, and habits; as also by the constitution of the ambient air, and state of the blood, both as to quantity and quality: for in some this flows quicker, in others slower; in some it abounds, in others it is deficient; in some it is very bad, in others in a better condition.

As to young men, whereas the change in their blood is already made, its maturation finished, and the particles of moisture, which should cause putrefaction, are now exhaled; hence it follows, that this disease cannot be generated in them, at least but very seldom, that is, in such whose blood still abounds with too much humidity, or is very corrupt, with a violent inflammation; or who, perhaps, when they were children, had been attacked with the chicken-

pox, when their blood had not yet passed from the first state to the second; or lastly, who have a moderate heat, that is, without much moisture; and when they had the chicken-pox, were of a dry temperament, and lean.

In an advanced age, the distemper will scarcely appear, unless perhaps in putrid, malignant, and pestilential constitutions of the air, in which this disease chiefly rages. For such an air disposes bodies very much to heat and moisture; and an inflamed air promotes eruptions, by blowing up the spirit in the ventricles of the heart, and communicating to it the like disposition, which, by the force of the heart, is sent into the blood, which is in the arteries; and brings it into the same state of corruption.

Thus we have sufficiently, though succinctly, treated of the causes of the small-pox. We shall now proceed to shew, what bodies are most disposed to this disease and the measles.

C H A P. II.

Of bodies disposed to the small-pox.

BOdies inclined to this disease are generally such as are moist, pale, and fleshy; the well-coloured also, especially, if they are ruddy and tending to brown, are disposed to it, if they are loaded with flesh. So are likewise those who are frequently liable to acute and continual fevers, to running of the eyes, red pimples, and boils, proceeding from the eating of sweet things; as dates, honey, figs, grapes, and all those sweets in which there is a gross humour;

mour; particularly, thick gruels, food made of underground wheat, with honey and water, or a great quantity of wine and milk.

Lean, bilious, hot, and dry bodies are more inclinable to the measles, than to the small-pox. But if they happen to be taken with the small-pox, the pustules are either few, distinct, and favourable; or, on the contrary, very bad, irregular, deceitful, dry, with putrefaction, and no maturation.

Lastly, thin, and dry bodies, of a cold temperament, are neither subject to the small-pox, nor to the measles. And if they happen to catch the small-pox, they have but few, in a moderate way, and without danger, with a very slight fever; because such constitutions extinguish the disease in its very beginning.

The seasons of the year in which the small-pox are most frequent, are various; they rage most at the latter end of the autumn, and the beginning of the spring: and when in the summer there are great and frequent rains, with continual south-winds; and lastly, when the winter is warm, and the winds southerly.

When the summer is excessively hot and dry, and succeeded by a hot autumn, in which rains come on very late; then the measles quickly seize those who are disposed to them, that is, those who are lean, hot, and of bilious constitutions.

But all these things admit of great differences, by reason of the diversity of countries and places, and occult dispositions in the air, which bring on those distempers, and render bodies subject to them. And therefore, at such times great diligence is to be used

in the preservation from them ; as we shall shew in the sequel.

C H A P. III.

Of the prognostic signs of the eruption of the small-pox and measles.

THE eruption of the small-pox is preceded by a continual fever, a pain in the back, itching in the nose, and terrours in sleep. These are the proper signs of the approaching small-pox, especially the pain in the back, with a fever ; and also a pricking, which the patient feels all over his body ; together with a fulness and redness of the face, which at times goes and comes : a redness of the eyes, a heaviness of the whole body ; frequent yawnings, a pain in the throat and breast, with a difficulty in breathing, and straitness in the gullet, then a dryness of the mouth, thick spittle, a hoarseness of the voice ; head-ach, anxiety of mind, inquietude ; sick qualms and heaviness of heart : with this difference, that anxiety of mind, sick qualms, and heaviness of heart, oppress more in the measles than in the small-pox, unless the small-pox be of a bad sort ; for the measles are from a very bilious blood. And, on the other hand, the pain in the back, the heat and inflammation of the whole body, especially in the throat, with a shining redness, are more proper to the small-pox than to the measles.

Wherefore, upon the appearance of these signs, or some of the worst of them, you may be assured, that one or the other of these diseases is nigh at hand.

As

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As to the safer kind of the small-pox ; in these, the quantity of blood is greater than its bad quality ; and hence arises the pain of the back ; the greater blood-vessels, which are situated near the vertebræ of the back, being distended with too great a quantity of blood.

C H A P. IV.

Of the regimen, or cure of the small-pox in general.

THE first article shall be of the preservation to be used, before the signs of the small-pox appear ; and after they have appeared, how the disease may be lessened.

The second, concerning the eruption.

The third, the care to be taken of the eyes, ears, nose, throat, and joints.

The fourth, of the ripening of the pustules.

The fifth, of their drying.

The sixth, how the scales and crusts are to be cleared from the eyes, and the rest of the body.

The seventh, of destroying the marks.

The eighth, of the diet in the small-pox.

The ninth, of regulating the discharge by the intestines.

The tenth, of curable and incurable small-pox and measles.

Of each of these I shall, God willing, briefly, but sufficiently discourse.

C H A P. V.

Of preservation from, and lessening the disease.

Blood ought to be taken away from children and young men, if they have never had the small-pox, or have only had what is called the chicken-pox, (especially at such seasons as we have above described), before they are seized with a fever, and the signs of the disease appear. A vein may be opened in those who are fourteen years old; to those who are younger, cupping glasses must be applied, and their lodgings should be kept cool.

Let their diet be yellow lentils, tarts made of unripe grapes, minced flesh-meat, dressed with vinegar and honey, or with the acid syrup; to which raisins, a few figs, and chiches are sometimes added: also kid-broth, veal-jellies, and boiled woodcocks and hens. But these must be mixed with the juice of unripe grapes.

Their drink should be water cooled with snow, or clear spring-water cold; with which their chamber may also be sprinkled.

Let them frequently eat acid pomegranates, and the inspissated juices of acid and astringent fruits, as pomegranates, currants *, and the like.

Where the constitution is hot, and there is a great inflammation; barley-water, with a fourth part of acid pomegranate juice, may be drank in the morning.

* The Arabic word is *Ribas*, which also signifies a sort of *lapathum acetosum*, or sorrel, of which the red and acid juice boiled to two thirds, is called *Rob de Ribus*. See *Golii lex.*

But

But if the heat be less, a ptisan of barley, with sugar, is proper; and vinegar, lentils, pomegranates, and the juice of unripe grapes, may be added to the food; for all these thicken and cool the blood, and make the distemper more mild.

This regimen is of great service in all times of pestilence; for it diminishes the malignity of pestilential ulcers and boils; and prevents quinseys, pleurisies, and all distempers arising from bile and blood.

The patient may go into cold water, and swim in it about noon. He must abstain from new milk, wine, dates, honey, and, in general, from sweet things, and meats, made by a mixture of flesh, onions, oil, butter, and cheese; from mutton, beef, shell-fish, high-seasoned things, and hot seeds. Instead of these, in times of contagion, he may eat young birds: and if the temperament be hot and moist, liable to putrefaction, or hot and dry, and apt to be inflamed; he must eat as follows; that is, in the hot and dry constitution, cooling and moist garden-herbs, purslain, mallows, beet, gourds, cucumbers, sorrel, and small pumpions.

As to sweet melons, they are forbidden; and if any one by chance eats of them, he must presently drink a spoonful of the juice of some of the acid fruits. He may be allowed soft fish, and butter-milk.

To the food of those who are corpulent, fleshy, and of a rudy complexion, such cooling and drying things, as we have mentioned, may be added. They should all forbear labour, fatigue, bathing, venery, walking or riding in the sun, and dust, drinking of stagnating waters, blasted fruits, or mouldy herbs; and also figs and grapes: because these drive the humours

mours to the skin, and, filling the blood with flatulent spirits, dispose it more to fermentation and ebullition. Their body must be opened, if there be occasion, with the juice of prunes and sugar, or with whey and sugar. If the air be putrid and pestilential, their face may be continually sprinkled with the water of sanders and camphire; which, if it pleases God, will have a good effect.

As to sucking infants; if they are fat and ruddy, and above five months old, let them be cupped; and let the nurse, as far as possible, be managed in the manner we have mentioned.

I come now to those medicines which thicken and cool the blood, and check its ebullition and putrefaction.

All acid things are proper for this purpose, especially the water called *al-raib*, that is, the sour, bitter water which swims upon butter-milk exposed to the sun; and the acid juice of citrons.

The same intention is very well answered by many things, which have an astringency joined with their acidity, and thereby condense the blood. Such are, four grapes, sumack, rob ribas, or the inspissated juice of currants, apples, quinces, and pomegranates; jujubes, lentils, coleworts, coriander, lettuce, poppies, endive, night-shade, sugar called *bambu**, the seeds of fleawort, and camphire.

The following composition is good to cool the blood, and restrain the heat of the liver, and effervescence of the bile.

Take of red roses beaten, ten drachims; bambu-su-

* The Indian name for a concreted juice, like sugar, in an Indian reed.

gar,

gar, twenty drachms; sumack, the seeds of wild sorrel, lentils peeled, barberries, the seeds of purslain, seeds of white lettuce, of each five drachms; red sanders, two drachms and a half; camphire, one drachm.

Let these be mixed, and give three drachms of this powder to the patient every morning in his drink, together with an ounce of the juice of wild sorrel, or of ribas, pomegranates, or unripe grapes, and the like.

The medicine al-facangjabin, that is, oxymel with sugar, is likewise good, which is thus prepared.

Take one part of red, sharp vinegar, depurated; two parts of rose-water; mix, and infuse in the cold mixture, one ounce of red roses; half an ounce of balauftines; two ounces of pomegranate-peel, for the space of three days. Then strain the liquor, adding to it, according to the quantity of the vinegar, twice or thrice as much of the sugar tabar zad, that is, white sugar-candy. Boil it sufficiently, and use it.

It will also be of use to take of roses and bambu-sugar, of each ten drachms; white sanders, three drachms; camphire, one drachm; and moisten them with the mucilage of the seeds of fleawort; then make the mass into pills, or troches. Of these, at proper times, three drachms may be given in the patient's drink, together with one ounce of the aforefaid al-facangjabin.

Besides these, the following syrup is excellent, and wonderfully exceeds in virtue all others, which I have seen tried; though perhaps the syrup of pearls, which the Indians describe, and of which they boast more than they can have experienced, may be more powerful. For they say, that if any one drinks of that
syrup

syrup, though nine pustules have already appeared, there will not come out a tenth.

Now, the composition of mine is this.

Take of red vinegar depurated, old, and sharp, three pounds; of the juice of acid pomegranates, the acid juice of citrons, the juice of unripe grapes, of ribas, of the Syrian mulberries, the expression of Syrian sumack, and barberries, of each one pound; the juices of lettuce and tarragon, of each a quarter of a pound; of the decoction of red jujubes, and the infusion of lentils, each a pound and half. Mix all together, and add three pounds of sugar; boil the whole, and put to it some of the syrup already made, hot, working it with a pestle, till it is dissolved: then mix it with the whole, stirring it continually with a stick of camphire-wood; throw it into a mortar of stone, or willow-tree wood, taking out the clearest part all the while; having added and mixed bambu-sugar and camphire. Use this before the small-pox appears, and also after the appearance, as we shall direct anon. It is also proper in all distempers, which arise from a bilious blood, in pestilential ulcers, boils, quinseys, and the like.

What I have said may in general suffice concerning preservation from the small-pox, before the fever, which attends their signs, comes on.

The last-mentioned syrup repels the disease from one, who is in such a condition, that it can be repelled; so that what comes out will be very moderate. It also effects, that the change of the blood from the first state to the second, should not be done too hastily, and at once, with too great ebullition, and frightful and dangerous symptoms; but by degrees,

grees, and in a longer time ; in the way of maturation, not putrefaction, without terrible and dangerous fevers.

But when the fever, which accompanies the eruption, arises, this regimen is no longer to be used, unless with great caution and prudence ; for a mistake here is very dangerous, for this reason, that while the blood is rarefied, and nature, according to the temperament of the patient, is endeavouring to expel the morbid matter ; if then the refrigeration and condensation, which you intend, does not exceed the cool state the patient was in before, it will happen, that the ebullition will break out a second or third time ; and thus nature will be disturbed in her work. Neither can that ebullition be checked, without great danger : for those remedies must be used for this purpose, which do in a manner congeal and coagulate the blood ; such are, opium, hemlock, a great quantity of juice of lettuce, night-shade, and the like. And the congelation of the blood, and extinction of natural heat, by all these, is not safe ; because of the excess, which is easily committed : for it will be hard, at the same time to repress the effervescence, and preserve the due natural heat. In one word, care must be taken, not to extinguish preternatural and natural heat together

Now I shall communicate a practice, which physicians, either through ignorance or avarice, that they only may receive profit from it, usually conceal ; and it is this. When you observe, upon the signs of the disease, a distension of the belly, pain in the back, redness of the face and eyes, a violent headach, with a full pulse, and also a straitness of breath, a red and turbid.

turbid urine, and such a heat of the body, as a man feels, who has been for some time in a hot bath; especially, if the body be fleshy; there is then all the reason in the world to take away blood. Wherefore, draw away a good quantity, even till the patient faints away. It will be best to do it from the basilic vein, or some of its branches; but if that cannot be found, from the cephalic vein. Sometimes, when the basilic does not appear, it may be taken away from the vein in the ankle; but better from the basilic or its branches, because they draw from the greater veins in the abdomen more than the cephalic does.

If the symptoms do not run very high, although they are manifest, draw blood but sparingly; and when they are less, take away very little. Then proceed in the cure with repelling medicines, as has been mentioned.

If by these the feverish heat is removed, and the pulse and breath are come to their natural state; still insist on the use of them, till the heat of the disease is perfectly abated, which will be done in a short time.

In order more effectually to perform this extinction, let the patient drink water, made cold in snow to the highest degree, very plentifully and often; so that he may feel the coldness of it in his bowels. If, after this, the fever and burning return, give this water, a second time, two or three pints, or more, in the space of half an hour.

If still the heat return, and the belly be full of water, make him vomit it up, and then give it again. And if the water finds a passage, either by sweats or urine, you may be assured the patient is in a good way.

But

But if the water does not pass, and the heat returns as it was at first, or even is more violent; omit giving the water so often, and have recourse to the other extingvents, which have been described; and if the patient finds relief, persist in the use of them. If, on the contrary, you perceive, that they produce an intolerable uneasiness and inquietude, you may certainly know, that the eruption of the small-pox or measles is at hand. Wherefore you must quit this method, and hasten to assist nature, in expelling her superfluities in the manner I shall deliver in the following chapter.

C H A P. VI.

Of those things which hasten the eruption of the small-pox.

THE eruption of the small-pox and measles is promoted by the following means. The patient must be well wrapped up in cloaths, and his body rubbed all over. He must be kept in a room not very cold; he should drink frequently, a little at a time, of cold water, to provoke sweat, and assist the protrusion of the humours to the external parts.

The sick person must put on a double shirt, the borders of which must be bound. Underneath him, place two small basins of very hot water, one before, and the other behind him; so that the vapour may come to the whole body, except the face; by which means the skin will be rarefied, and disposed to receive the erumpent humour. For the surface of the body may, in this case, be compared to a leech, which, to

cool its own heat, attracts whatsoever it can. And by this management, not only is the skin softened, but the strength of the patient is also preserved; so that nothing can be more proper.

As to furnaces and baths, they are both destructive at this time, by so overheating and weakening, that a swooning follows; by which nature is diverted from its work with great danger, if the fit be violent and long: for nothing is a greater indication of the approach of death, the natural heat retiring into the inner parts; after which it will be soon oppressed and extinguished by the over-abounding humours. Likewise, when the hot vapour, which I have directed, is used, it must never be suffered to cool upon the body; but is presently to be wiped and dried off, with great diligence. This method is abundantly sufficient to forward the coming out of the disease, when nature is not languid, or the humours too thick and viscid.

But in case it happens, that the outward fever is indeed mild, but anxiety and inquietude continue, and the eruption is difficult; you must wait till the fifth day is over, and then use those medicines which promote the eruption. But this is to be done with great caution and all manner of attention, in the way which I have mentioned, when speaking of the rules to be observed in giving extinguishing remedies: for an error here, although it be not so great as the other, yet is also dangerous. And the caution consists in not being too hasty in giving these medicines, but to insist upon the former regimen, as long as there is any prospect of success without them; and as long as you are not yet certain, that the fever is too re-
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mils in the inward parts, as well as it is in the outward. This you will easily know, by the pulse and respiration not being too quick, full, or irregular; and if, in feeling the breast, you do not find it hot in the highest degree. For though the fever be doubly or trebly increased, it will not therefore be mortal; as you may judge by comparing this with other fevers, which you have observed in persons of the same temperament, and in the same degree of heat with your patient, who nevertheless have recovered.

These extinguishing remedies are also to be applied when, as soon as the pustules appear in the skin, the patient feels himself to be pretty well, and his pulse and breath are easy. But if, on the other hand, the eruption goes on slowly and with difficulty, they must be absolutely forborn: for to use them, is to strive against nature, and check the protrusion. And when any anxiety follows upon the use of extingvents, especially a palpitation of the heart, be sure that you have committed a great error. You must therefore immediately take all possible pains in softening the skin, in the manner I have taught; and give to drink frequently warm water, either alone, or in which fennel and smallage seeds have been first boiled, and the like simples which conduce to the eruption; according as the heat of the patient and his stomach will bear them; regard also being had to the slowness of the pimples in coming out.

This is the description of an easy, gentle medicine, which, without too much heat, promotes the eruption.

Take yellow figs to the number of thirty; raisins,

the stones being taken out, twenty drachms ; pour upon them three pints of water, and let them boil till they are dissolved. Give to the patient of this liquor half a pint, at three several times. Then cover him up well in cloaths, and foment the body, as is above directed.

The following is yet more powerful.

Take of the aforesaid decoction four ounces ; of the decoction of fennel and smallage seeds, two ounces : let the patient drink it, as has been directed.

One still more efficacious is this.

Boil fennel-seeds and smallage-seeds, of each ten drachms, in an earthen vessel, till the water is red ; strain it, and give three ounces at a time.

Lastly, this composition is very good and useful, at several times.

Take of red roses four drachms ; of lentils decorated nine drachms ; yellow figs ten ; of gum tragacanth three drachms ; of white raisins stoned, ten drachms ; lack, cleared from its sticks and washed, three drachms ; fennel and smallage seeds, of each five drachms. Boil all these in three pints of water, to one pint : strain the liquor, and give half a pint of it, with a sixth part of a drachm of saffron, twice or thrice, as there may be occasion.

We shall now speak of those parts of the body of which care is to be taken.

C H A P.

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C H A P. VII.

Of taking care of the throat, eyes, &c. as soon as the pustules have appeared.

AS soon as ever the signs of the small-pox appear, particular care must be taken of the eyes, the throat, the nose, and ears, and also of the limbs, in the way I am going to describe. Nay, sometimes it will be necessary to extend our care even to the soles of the feet, and the palms of the hands: for oftentimes violent pains arise in these parts, the hardness of the skin hindering the eruption.

Upon the first appearance of the signs, drop rose-water into the eyes now and then; also wash the face with cold water often in a day, and sprinkle the eyes with the same. For if the disease be mild, this method will prevent the pustules breaking out in them. This indeed is to be done, for greater caution; for in the mild sort, it seldom happens, that any pustules break out on the eyes. But in a bad sort, when you see a large eruption in the beginning, with an itching of the eye-lids, and redness of the white of the eyes, some places of which are redder than others; you may be assured that the small-pox will break out there, unless great help be given: therefore immediately drop rose-water, in which sumack has been infused, into the eyes, several times in the day.

It will be still more effectual to apply a collyrium, made of galls in rose-water, by dropping it into the eyes; or to instill into the eyes what is squeezed from the pulp and skins of the sour pomegranate, first

chewed. Then wash the eyelids with a collyrium, made of the water of quinces, the juice of unripe grapes, box-thorn, aloe, and acacia : of each of these let there be one part, and a tenth part of saffron ; and drop some of it into the eyes.

But if you observe a turgescence in the humours, and the eruption to be very copious, so that pustules will certainly fall upon the eyes, because redness appears here and there in their white part, from the excess of the inflammation ; and also find, that what you have applied does not remove that redness, but only lessen it for a time ; after which it returns more violently than before, or at least continues as it was, when you began this treatment ; you must not proceed any longer in this method, but, instead of these things, drop into the eyes some of the acid liquor expressed from mouldy bread, with the Nabathæan bitter, in which there is no vinegar, or other acid.

As to the pustules which break out in the tunica cornea of the eye, these darken the sight, and are to be cured, according to the degree of their thickness, by such dissolving remedies as I am going to describe : which indeed are sometimes effectual, and sometimes not ; the success depending upon the matter being more or less thick, and upon the greater or less firmness and driness of the body.

But if large pustules shew themselves in the tunica uvea, use the collyrium of rose-water several times in the day and night with great diligence ; or else that before mentioned, leaving out the saffron ; instead of which, put a small quantity of blood-stone, to keep down the swelling.

These things are what ought to be known concerning

ing the eyes. Care is next to be taken of the throat and mouth, lest any eruption there should grieve the patient, and hinder his breathing; for it often happens, that, in a bad kind of the disease, terrible suffocations are brought on, which leave no hopes of a recovery.

Therefore, on the first appearance of the signs of the small-pox, let the mouth be gargled with the water of acid pomegranates, or of sumack, or with the juice of mulberries, or with some of those things which we have recommended, (chap. V.), under the head of extinguent remedies; or lastly, if nothing else be ready at hand, with pure cold water; and that very often, to prevent a great eruption into the throat and mouth, and strengthen those parts, or at least hinder what is already broken out there from causing a suffocation. Be quick therefore, and diligent in applying this cure, especially, if from a hoarseness of voice, straitness in breathing, and a pain in the throat, a necessity of it shall appear.

Moreover, if the strength will bear it, take away blood from the cephalic vein; and that even after the whole eruption is over. And if the patient find any thing in his mouth, or throat which hurts him; and yet there is not too great a heat there, neither are his bowels too loose, let him lick by degrees of fresh butter mixed with white sugar-candy. But if there be any heat and inflammation there, give a linctus of this kind.

Take of sweet almonds decorticated one part; of the seeds of gourd two parts; of white sugar-candy three parts; the mucilages of the seeds of fleawort, and of laurel-berries; a linctus of gum-arabic, almonds

180. Of taking care of the THROAT, &c. Chap. VII.

monds peeled, and the seeds of the plane-tree, and wheat-flower : mix all these with a mucilage of quince-seeds.

In the next place, let us take care of the limbs ; for upon these a number of very bad pustules often arise, which corrupt them to such a degree, that the muscles, tendons, nerves, and the bones themselves lie bare. Assist therefore immediately, if you observe the signs of the disease to be violent and excessive ; that is, bathe the limbs with fanders, quince-water, Armenian bole, roses, camphire, vinegar, and rose-water : but take care not to overdo it. If the pustules are very large, open them with an incision-knife, to let out the matter : and delay not this operation ; for the case is dangerous.

Now let us come to the cure of the nose and ears, lest they should be over-filled with the pimples : for this will greatly afflict the patient ; and when they break out in the internal part of the ear, there is danger of their coming presently into the nose. Take therefore a cotton cloth, upon which camphire has been broken ; by the help of this, put into the ear fragrant wine-vinegar, to which has been added quince-water, or the juice of box-thorn. Do this in the morning, and repeat it twice or thrice a-day.

Lastly, if a great pain arises in the soles of the feet, prepare instantly to anoint them with warm oil, and foment them with warm water and cotton. If this does not assuage the pain, nor facilitate the eruption, beat up decorticated sesam with milk ; anoint with it, and bind it on with cloths, and leave it upon the part all night. In the morning, put the foot into warm water ; and repeat the same again.

Or

Or bruise dates with butter, and apply them; or, lastly, anoint with the lees of the sesamine oil. For these and the like things soften and relax the skin; and by this means diminish the pain, and promote the eruption.

C H A P. VIII.

Of ripening the small-pox.

WHen, after the eruption is completed, you observe the pustules tend too slowly to maturity, and yet that the patient is otherwise in a very good way, as to his respiration and pulse, and pretty free from inquietude and anxiety; then it behoves you to assist the maturation of the pustules.

But if, together with a backwardness of ripening after the eruption, you perceive the pustules to become hard and warty, and the patient not at all better; or if his illness increases; then you are to know that the small-pox is mortal. Wherefore have no thoughts of ripening the pustules; for they are of that kind which cannot be ripened.

Now, the maturation of the small-pox, if curable, is to be effected by fomenting the body with the steam of a hot decoction in water of camomile, violets, melilot, marsh-mallows, and bran, either separate, or collected together in two basins; as we have directed above, where we treated of facilitating the eruption.

And if then the patient seems to find relief and refreshment by the fomentation, you are to abstain from those fumigations which are commonly employed for

for drying up the pustules ; until they ripen of themselves, and are capable of bearing those things which contribute towards drying them up : of which we are now going to treat.

C H A P. IX.

Of drying the pustules.

IF the pustules are large and very numerous, they must be dried ; or the fluid contained in them must be soaked up with fine clean cotton, in which there is nothing that may hurt the patient. And then let fumigations be made with the leaves of dried roses, or with the leaves of the storax-tree, or with sanders, or with the leaves of the iris, or the tamarisk : and indeed roses are more convenient in summer, but tamarisks in winter.

The small-pox sometimes abounds with too much moisture. When that happens, order the patient to lie on pounded roses, or on rice-meal, or on millet-meal, with which a mattress of a thin texture is stuffed.

If the body be full of pustules, lay moist leaves of the iris under the patient ; and besprinkle him with an aromatic powder made of aloe, frankincense, sarcocol, and dragon's blood.

But if the pustules break spontaneously, or from the quantity of the fluid contained in them, and are slow in drying, treat them in this manner.

Take of sesamine oil one ounce ; of Andarene * salt

* Andar is a village, a mile distant from Aleppo, where a very white fossil salt is found. See Maundrell's journey.

pounded

pounded fine, and of alum, each two drachms. With this liniment anoint the body, carefully avoiding those places which are ulcerated or excoriated, or even too near an approach to them; because the medicine would raise a violent inflammation. Let the liniment lie on the parts for the space of an hour; then wash it off with a decoction in water of emblic myrobalans, white tamarisk-berries, myrtle-leaves, and pomegranate-peels.

If the pustules are dried by these means, it is well; if not, take the whitest sort of bole (not the red bole), add to it of Andarene salt, and of dry bread crumbled fine, each a tenth part. Make a liniment, with which rub the skin; let it lie on for an hour or two, and then wash it off.

Now we are to treat of taking off the dried scales, and crusts, or eschars,

C H A P. X.

Of taking away the dry scabs and eschars.

WHen the small-pox is withered, and the dry scales and eschars still remain on the skin, examine them well; and to those that are small, and thoroughly dried up, apply warm sesamine-oil every now and then, till they are softened, and fall off: but those of the face are to be managed with oil of pistaches. For the larger sort, which resemble eschars, if you find any moisture remaining in them, cut them off carefully, without any application of oil. And if the places from whence you have removed the eschars, contain but little moisture, it is to be dried up with
soft

soft cotton, as I have already said : but if they contain much, they are to be dried gradually ; besprinkling them with the red aromatic powder, composed of aloe, frankincense, sarcocol, and dragon's blood, especially if they begin to lessen, and sink in ; and with alum and Andarene salt, if they are even with the rest of the surface of the body, and do not sink in : then wait till a new eschar or scab is formed on them. If there be any return of moisture, repeat the same dressings. And in fine, when the moisture is entirely exhausted, then anoint the parts with oil, until the crusts are softened, and all fallen off.

Next follows a discourse on destroying the marks of the small-pox.

C H A P. XI.

Of destroying the marks of the small-pox.

THE marks of the small-pox are of two sorts : for they are either in the eye, or on the rest of the body. Now, with respect to the eye, the part on which the small-pox broke out, has an opaque whiteness in it, as we have already observed. If this happens in the eyes of children, or young persons of a moist constitution of body, and tender skin, it will be the more easily deterged.

Now, the medicines which deterge the eye, and take off the whiteness, are these : borax, or nitre made into cakes, Andarene salt, sal-ammoniac, glass, the scorix of glass, coral, tummy, lapis hæmatites, verdigrease ; bastard sponge, the sea-crab, the dungs or excrements of sparrows, swallows, starlings, mice, bats,

bats, and of the Arabian or Lybian lizard ; musk, the sediment of urine ; the acorus, ebony, cornel-water, Arabian sugar, dregs of vinegar burnt, myrrh, sandarach or juniper gum, commonly called *varnish*, gums of the olive and bitter almond trees, and the milky juice of wild lettuce. It will be best to use these, when the patient is just come out of the bath, or after holding his head over the steam of hot water. But mild medicines alone, nay the mildest of these, are to be employed, especially in soft and moist bodies.

The description of a mild medicine, which removes the white specks from the eye.

Let the eye be sprinkled with sarcocol, and white sugar-candy.

Another more efficacious.

Let the eye be sprinkled with bastard sponge, sarcocol, and sugar.

Another still more powerful.

Take of verdigrease ten drachms ; myrrh, sagapenum, sal ammoniac, sarcocol, of each two drachms and a half ; bastard sponge, scorix of glass, and borax, or nitre in cakes, of each three drachms. Then take of sweet cane ten drachms, and the same quantity of cornel-water. Boil these in ten times the weight of water, till the decoction becomes thick : then dissolve the gums in it, and mix all well together into an ophthalmic collyrium. Afterwards, as occasion shall require, to this mixture add ebony in an oil-bottle. Cleanse the part affected gently and often with a needle or style ; taking care to apply the collyrium frequently, both before and after the operation. And lastly, sprinkle it with the powder of

the milder sort of the medicines. But be sure to look carefully into the eye every day. For if it be painted, or look angry, omit this treatment for some days, and then repeat it ; for this method of cure is very powerful and efficacious.

As to the medicines, which take off the marks of the small pox from the face and the rest of the body, they are these : white litharge, dried reed-roots, rotten bones powdered, bastard sponge, coral, sarcocol, almonds, birthwort, the ben-nut, radish-seed, pumpkin-seed, rocket-seed, the flower of beans, rice; lupins, and kidney-beans. On these pour the aqua amurcæ, and barley-water.

The description of a liniment, which effaces the marks of the small-pox.

Take of the flower of chiches and beans, each three drachms ; of pumpkin-seed five drachms ; of white litharge two drachms ; of dried reed-roots three drachms. Pound all together in barley-water : then apply it to the parts several times successively, after the patient has received the steam of hot water, or after coming out of the bath. Then again wash him in a bath, made of pumpkin-rinds, dried violets, bran, and pounded chiches, boiled in water : rub him well, and apply the liniment a second time.

The description of another liniment of greater efficacy.

Take of bean-meal five drachms ; bitter-almonds, sweet costus, rocket-seed, and radish-seed, of each two drachms and a half : apply it, as we have already directed.

Another liniment more efficacious still.

Take of bitter almonds peeled five drachms ; radish-

dish-feed, rocket-feed, roots of costus, and long birthwort, of each two drachms and a half; of borax, or nitre made into cakes, three drachms; of pepper one drachm and a half: use them as we have already directed. Afterwards, wash the parts with radish-water, or with those things which we have ordered. And those are the medicines which efface the marks and scars of the small-pox,

But in order to efface the pock-holes, and render them even with the rest of the surface of the body, do thus: Let the body be anointed with butter, and well tinged with the herb cyperis, or with its powder; let the patient use the bath frequently, and be rubbed down after it.

Now we are to direct what ought to be given to a patient in the small-pox by way of aliment, and to treat of the medicines which have relation to it.

C H A P. XII.

Of the diet of patients in the small-pox.

TO a patient in the small-pox it is necessary to give barley-water, prepared in the same manner, and with the same art, as that which is usually given to persons in acute and hot diseases. If the fever be moderate, and the body somewhat costive, it must be sweetened with white sugar-candy; but if the heat of the fever be intense, and the body loose, pour to it half a measure of the juice of acid pomegranates, pounded with their seeds: but the pulps and inward thin tunicles are to be avoided; for they are laxative.

If the patient be restless, and cannot sleep, add to

the barley-water some proportion of poppy. But if the body be very loose, add to the barley-water one part of dry seeds of acid pomegranates, and one part of poppy.

But, if it be requisite to bind the body, instead of barley-water, take meal of peeled barley, and the meal of pomegranate-seeds; boil these in the same manner as barley-water is made, and let the sick drink of this, as he would drink of barley-water either alone, or with bambu-sugar and gum-arabic mixed with it, if a looseness should make it necessary; or with the medicines which I shall describe anon. For barley-water, mixed with pomgranate-juice, is very serviceable in the small-pox, and more especially in the measles. But the waters of the gourd, of the Indian pumpion, and of the cucumber; the mucilage of fleawort-seeds, and the like, of whatever kind, which make a mild phlegm, and easy to be spit up; these waters, I say, are more useful in the measles, than in the small-pox; unless it be in those sorts of the small-pox, which are accompanied with a malignity and heat, together with a violent fever and want of sleep.

But in those cases of the small-pox, wherein the fever and inflammation are not so vehement, those things above mentioned, and others of the like kind, have no other effect, but to render them slower, and to protract the whole course of the disease: wherefore it will be your business to have recourse to this or that sort of medicines, or to abstain from them, as occasion shall require. For when the small-pox happens to be in the highest degree of heat and putrefaction, with the addition of moisture; then those things which have a cooling, drying, and condensing quality, are more proper; such as juice of pomegranates,

granates, verjuice, and others of the same nature.

But when the disease is the measles, which arise from a vehement ebullition of the bile blended with the blood; those things which have the twofold virtue of cooling and humecting, are the most proper in their cure; inasmuch as the corrupted blood is tempered and corrected by their means. For the blood of a person, in the measles, is like stagnating water, which putrefies by long standing; whereby its natural texture is destroyed, and, by the action of the sun, it contracts a vitious acrimony. But if these waters are mixed with rain, or any other running sweet water, they soon recover their former wholesomeness.

Moreover, in the small-pox barley-gruel is beneficial, if it be taken with sugar and pomegranate-juice, or with a proper quantity of julap; giving due attention to the patient's loose or costive state, as likewise to his greater or lesser degree of heat: except that barley-water is lighter to take, easier to swallow, and more suitable to the throat and breast. Wherefore, act according to those directions, after you have been apprised, that barley-water is more proper for persons in the measles, than in the small-pox; unless the small-pox happen to be of a bad sort, in the manner we have mentioned.

As to the rest, vetches well cleansed are good in the small-pox, if a food be prepared of them with the juice of acid pomegranates, or with vinegar: the meal of lentils is useful also, if the meal be wrought up with cold water.

Know likewise, that cold water is more serviceable to a patient in the measles, than in the small pox; as being safer, and of a more certain effect.

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Now, when you see the small-pox attended with great inflammation, and a stoppage in the pulse and respiration ; then give extinguishing medicines, proportioned to the symptoms : if they are less urgent, employ few ; if very urgent, employ many.

But never allow the eating of young birds, until the pulse and breath have returned to their natural state ; nor till the pustules are thoroughly withered, and the scabs fallen off.

Let us now turn the discourse upon loosening the belly, and restringing the same in the small-pox.

C H A P. XIII.

Of managing the discharges of the belly, in the small-pox.

THE belly is generally loose in the small-pox and measles towards their decline, but especially in the measles. For which reason, every thing must be avoided which opens the body, after the small-pox and measles are conducted to the end ; even though the body be bound. But if it be lax, instantly abstain carefully from those things which give stools : although it be necessary in the beginning of these two diseases, and before they are on the decline, to give a laxative. For it is sometimes requisite to open the body in the small-pox, either upon account of the excess of heat and pain in the head ; or in order to ease nature of her load, and lessen the morbid matter, when you have reason to think it over-abundant. And it will be really so, when you find the body, both before and after bleeding, neither weakened nor wasted ;

wasted ; but, on the contrary, bloated and full, with a paleness, or a little redness, and a fluctuating pulse. For sometimes, in such a state, bleeding will not be necessary, and it will be sufficient to evacuate the superfluous humidity : and that especially, when the aforesaid signs evidently appear ; and besides, if, through the sluggishness of the fever, the body be dejected, and entirely void of a red colour. In this state, a very proper medicine is a decoction of yellow myrobalans, if it be drank with white hard sugar, and the juice of an acid pomegranate, (two or three, if there be occasion), bruised with the pulp and internal tunicles. For it is the quality of these two medicines to purge the body of the superfluous humours, together with part of the bile, without raising any heat ; especially the pomegranate-juice ; and to leave nothing behind them in the intestines. And this is the best medicine which can be given in this case.

But in the measles give the juice of Damascene plums, and the plums themselves, fresh gathered, either alone, or bruised with julap, adding sugar to them. But avoid the medicine called *tarangioben* * ; for it is as prejudicial in the measles, as honey is in the small-pox ; both upon account of the excessive heat which it occasions, and of increasing the nauseating and uneasiness of the sick. In like manner carefully avoid giving them the juice of ivy, or of the black violet to drink ; because they both equally heighten the disorder in the body.

Now, whereas the first and most necessary remedy

* A sort of manna among the Sogdians, Medes, and Babylonians, which concretes on the leaves of certain shrubs, and is gathered thence.

in the small-pox, is to draw blood, when it is too much in quantity, or there is no prospect of checking its ebullition by any other means, even by extingvents; but there is a necessity for taking a little away, as well for relieving nature, as for abating the fulness of the blood-vessels, and easing them of their over-great load, which must otherwise be productive of very bad consequences; especially if the blood be heated to that degree, that a violent inflammation might ensue: in the same manner it behoves you, in the beginning of the measles, to draw off some of the bile, when you perceive it over-abundant; and then to pursue what remains of it by extingvents. Now, the sign of an excessive redundancy of the bile is, the violence of the inflammation, and the uneasiness, together with the discharge of the same bile, both by vomit and stool, and a bitterness in the mouth.

But if the quantity of the bile is not excessive, and yet there is an uneasiness, and thirst, and vehement heat, without any appearance of bile, either by vomit or stool; though its quantity, I say, be not excessive, we may however judge it to be of a bad quality, in proportion to the violence of the inflammation and uneasiness.

And this is what I have thought proper, that you should know, concerning the management of the discharges of the belly, when it is loose in the beginning of these two distempers. Now, if the belly be lax, give nothing laxative; for in this case, any thing that increases the discharges is not safe in either of the distempers. But while the belly continues loose, order the patient, instead of barley-water, to drink barley-gruel; and if it be necessary, boil the barley-gruel with

with meal of pomegranate-seeds; of which let him drink, before he returns to the use of barley-water. And if, this notwithstanding, the looseness still increases, mix gum-arabic and bambu-sugar in his drink in this manner.

Take of gum-arabic two drachms; of bambu-sugar one drachm: reduce them to the consistence of a collyrium: then on four ounces of the barley-gruel pour some of the medicine which I am going to describe; let it stand for an hour, and give it to the patient to drink.

The description of the medicine.

Take of red roses ground fine, bambu-sugar; sorrel-seed, fumack, and barberries, of each equal parts; also gum-arabic, sealed earth, poppy-rinds, balaustines, or pomegranate-flowers, of each half the quantity: let the patient drink three drachms of these, with one ounce of the juice of acid pomegranates.

But, if the looseness still continues, and has weakened the patient, give him draughts of al-râib, that is, four skimmed milk, with the best sort of biscuit, and a little gum-arabic.

Finally, whenever a dysentery appears, the method of cure must be taken from the place where we have treated of that subject.

Now, it remains, that we speak of those who recover, and of those who die of the small-pox and measles.

C H A P. XIV.

Of the curable and incurable small-pox and measles.

THE small-pox and measles are of the number of hot diseases, and therefore have many things in common with them. Now, the chief prognostic signs in those who recover, are, a freedom of respiration, a thorough soundness of mind, and an appetite for food, an agility to motion, a right state of the pulse, the patient's good opinion of his disease, a convenient posture in bed, and but little tossing about and inquietude of body.

Hence, a judgment may be formed of bad signs, the greatest part of which we have related in the book, entitled, *Almanfori* *.

These things following particularly regard the small-pox and measles.

When the pustules of the small-pox are white, large, separate, few in number, easy and speedy in coming out, and the fever not violent or burning, nor attended with much inquietude of body or concern of mind; and are so qualified, that the heat, concern, and inquietude diminish upon their eruption, and entirely cease, when the eruption is completed: that sort is curable, and threatens little or no danger. To these the next in goodness are, white large pustules, though very numerous and coherent; if they come out easily, and their total eruption eases the patient of his uneasiness and excessive heat, as we have already mentioned.

* There is a MS. copy of this book in the Bodleian library, Narciss. Marsh, No 376.

But

But when their eruption is performed with difficulty, and the patient does not grow better upon their coming out, they are a bad sort: although there is not so much reason to be afraid, if he should be ill while they are coming out, as if he continues so after the eruption.

But there is a bad, and even a fatal sort of white large pustules, to wit, those which run together, and spread so, that many of them unite, and occupy large spaces of the body; or become like broad circles, and in colour resemble fat.

As to those pustules which are white, very small, coalescing, hard, warty, and contain no fluid; they are of a bad kind: and their badness is in proportion to the degree of difficulty in their ripening, and to the continuance of the symptoms on their eruption. But if the symptoms are not abated, after the eruption is finished, it is a mortal sign.

Those pustules also are all bad, which turn green, purple, or black. But if, besides, a swooning and palpitation of the heart come on; this is the worst sign of all, nay a sign of certain death.

And when the fever increases after the eruption of the small-pox, it is a bad sign. But if the fever ceases at the time of the eruption, it is a good sign. Doubled pustules indicate a great quantity of the matter of the disease: and if they are of the curable kind, they portend recovery; but if of the mortal kind, death.

Those measles are the safest, which have not too much redness: but if they turn pale, it is a bad sign; the green and purple sorts are both mortal. When either the small-pox or measles sink in suddenly, after they

they began to shoot out ; and then the patient is seized with inquietude and anxiety, and a swooning comes on ; it is a sign of speedy death ; unless they push out again, after they have subsided.

If the pustules appear on the first day of the fever, they will hasten their progress, and be of quicker motion : if the eruption is protracted to the third day, it will advance moderately ; but if the first appearance passes the fourth day, the eruption will be completed dully and slowly.

When the appearance begins on the good critical days, it is a salutary sign, especially if the patient finds himself better at the end of the eruption ; and so on the contrary. But when the pustules begin to run into one another, and to spread ; and at the same time the inquietude increases considerably, and the belly swells or is bloated ; then death is near at hand. When the smaller sort of pustules, which contain no fluid, grow hard ; and a delirium comes on at the same time ; the patient is near his end. When it happens that the small-pox and measles appear and disappear alternately, and are attended with anxiety and a delirium ; this is a sign of death, of what colour soever the pustules are : but it is seldom the case of white pustules, or of those which ripen quick. When towards the end of the small-pox there is a great perturbation of the humours, and the patient is seized with a very violent pain in a leg, hand, or any other limb ; or the pustules are speedily converted into a green or red colour ; and thereupon he grows weaker than he was before, and the weakness still increases by the quick returns of the pain, and the limb contracts various colours ; these are signs of death.

But

But if nevertheless the patient grows stronger, he will recover, and that limb will be cured.

Now, if you scarify that limb the very moment when the pain begins to seize it, you will render great service to the patient, if he grows stronger after the incision ; and the limb will also be preserved from mortification.

But, in this dangerous case, nothing cooling must be applied to the limb, upon any account whatsoever : but either scarify it, or plunge it into hot water, if you see that the patient can bear it.

Wherefore, as we have run over all the articles, which we proposed to ourselves ; and have amply enough treated, both of this disease, and the method of preservation from it ; we here break off the thread of our discourse.

*To the bestower of strength to finish this work, be
praise without end, as he is worthy of being co-
lebrated and praised.*

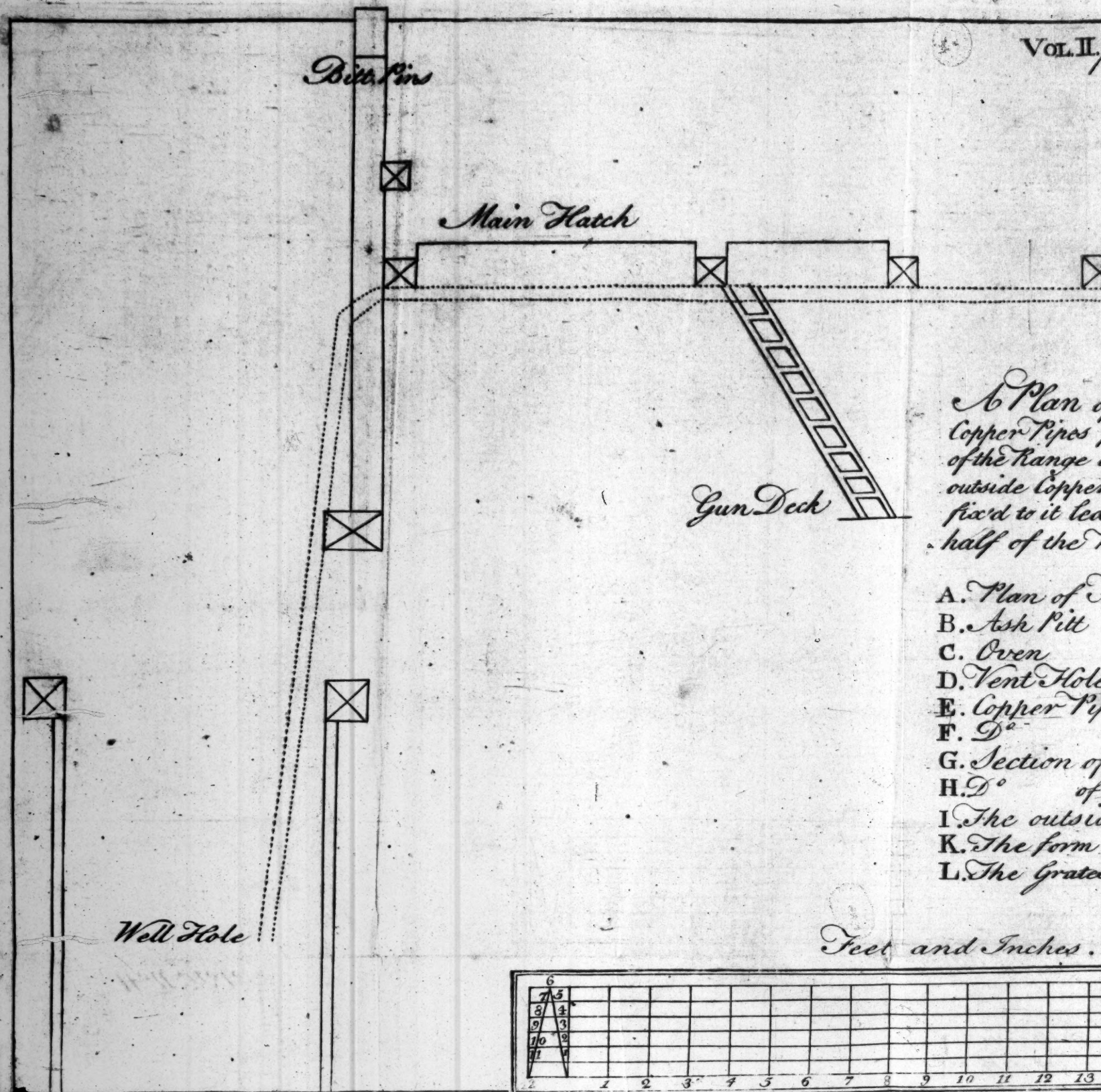
AN HISTORICAL ACCOUNT of
a NEW METHOD for extracting the
foul AIR out of SHIPS, &c.

P R E F A C E.

I Have often said, that it is not, in our country at least, so easy a thing to serve the public, as is commonly imagined; not meaning hereby the difficulty of finding out useful experiments, (although even that is great enough), but the hardships which attend the putting them in practice. Whence this should come to pass, it is foreign to the present purpose to inquire. They who are acquainted with the several motives upon which men often act, among which self-interest, envy, pride, and obstinacy, have no inconsiderable share, will readily see the springs of this seemingly unaccountable disposition of mind.

I would not have it thought, that I have had occasion to make this ill-natured remark, from what I may myself pretend to have done for the benefit of the public: but it is sufficiently justified by the opposition which the invention described in the following treatise has met with. The machine is so simple, and of so extensive advantage, that as it is surprising to see the greatest pains taken to make it abortive at first, so it is no less strange that it has not been so universally used, in the royal navy, as might have been expected from the great good which it promises.

It is not my business to examine the causes of this neglect;



Fore Hatch

A Plan of the Brick Work of the Furnaces and Range of the Copper Pipes fix'd as directed by Mr. Sutton with the Sections of the Range and Fire hole of the great Furnace shewing the outside Copper Pipe that lays on the Ashpitt with a Lead Pipe fix'd to it leading down the Ships Wellhole within four feet and half of the Bottom.

Plan of Furnaces
Ash Pitt

Oven
Vent Hole

Copper Pipes in the Ash Pitt
D^o in the Range

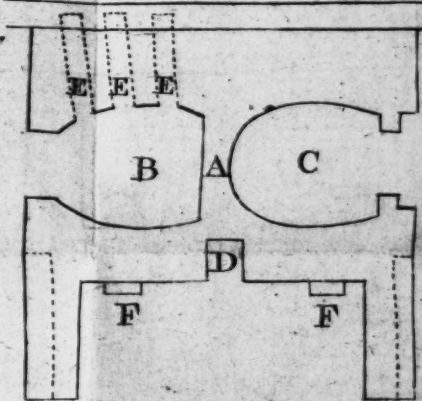
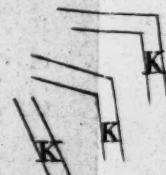
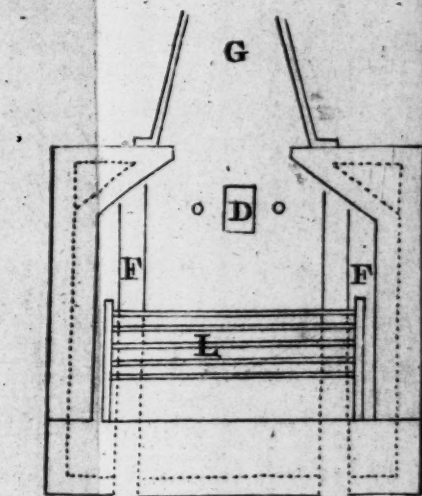
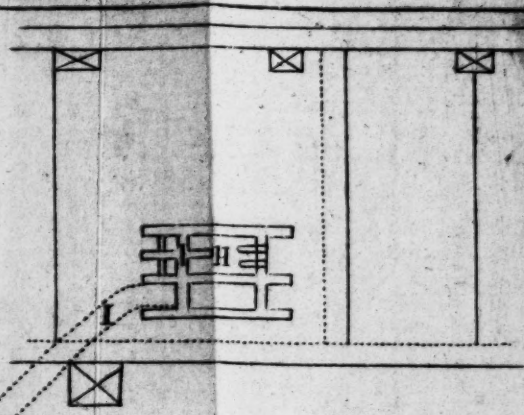
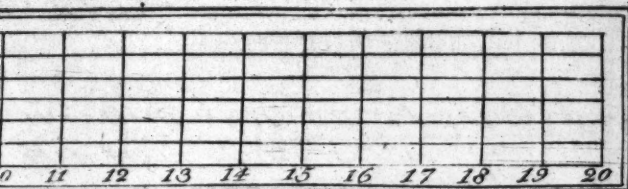
Section of the Range and Copper Chimney
D^o of the Fire Hole under the great Furnace

The outside Copper Pipe that is Joind to the Lead Pipe

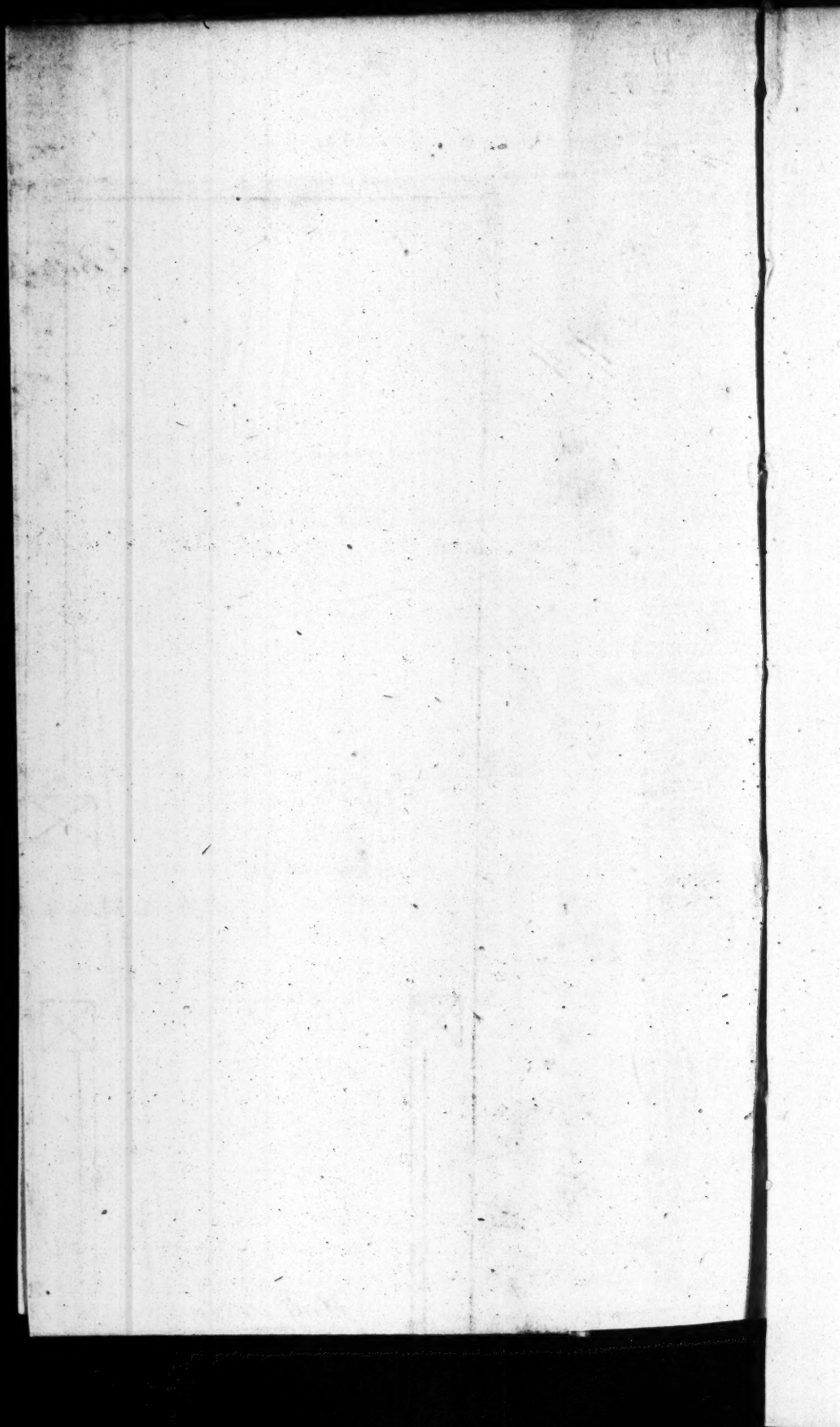
The form of the Copper Pipe that is Joind to the Lead Pipe

The Grates Standing between the Jambs in the Ranges

1. Inches.



The. Whinn. Sculp.



neglect; which is in a very moving and handsome manner complained of in the voyage of the great Lord Anson*; an immortal work, which will be always read with a pleasure, equal to the benefit to be reaped from it, with regard to our navigation and commerce to those parts of the world, to which the adventures relate.

As this hero is not less admired for his humanity and good sense, than for his conduct and courage; he has taken care that the relation of his enterprises should be a monument of the one, as well as of the other. The accounts given of that strange disease, so fatal to our seamen, the sea-scurvy, are hints so new and useful in physic, that I have thought it not unbecoming the place with which I am honoured in my profession, to write a short discourse on this subject, and give it to the honest and ingenious author, to be published together with his reprinted Account of a new method for extracting the foul air out of ships, &c.: an invention, which, I may venture to say, does honour to our nation, and will in time be found of more public benefit than any discovery in mechanics, which has been produced these hundred years.

Having therefore had the satisfaction, in the beginning, to recommend this experiment to the admiralty, I now join a short discourse on the scurvy to the reprinted edition of Mr Sutton's book, as a convincing and happy proof of the success which attends it. And the author has also added some other authentic accounts to the same purpose. From all these things duly considered, it is to be hoped that the evil spirit of opposition, which, as is mentioned in Mr Sut-

* See p. 36. 37.

ton's account, &c. exerted itself even against the making a trial, will now be rebuked and cast out.

To conclude, as any one versed in mechanics will easily see (as we formerly observed) that this management of the air may be applied to many other purposes of life, (to some instances of which I have been an eye-witness), so it will prove a great loss to mankind, if it is not universally brought into practice: especially, since, by the generosity and disinterestedness of the inventor, the whole expense may be considered as a trifle. Many more considerations might be urged; but they will readily occur to the wisdom of those whose province it is to direct our naval affairs.



The foregoing preface was written, and ready to be put to the press, when Mr Sutton brought me the agreeable news, that the Right Honourable the Lords of the Admiralty had just then given him orders, to provide all the ships of his Majesty's navy with this useful machine. Thus, laudable discoveries, though discountenanced at first, do at last break through all difficulties, and meet with suitable encouragement.

R. M.

An

AN HISTORICAL ACCOUNT of a NEW
METHOD for extracting the foul AIR
out of SHIPS, &c.

S I R,

PUrsuant to your desire, I now send you an historical account of my scheme, together with the reasons that first inclined me to employ my thoughts about it. In the year 1739, I was informed by a gentleman, that the sailors on board the fleet at Spit-head were so dangerously ill for want of fresh air, that they were put ashore to recover their health; and the ships to which they belonged, stunk to such a degree, that they infected one another. In compassion to my fellow-creatures, I thought myself obliged to do all that was possible for their relief in these unhappy circumstances, and from this time tried what could be done by fire. I at length found, that by stopping the air out of a room that had three fire-places, and making two large fires in two of them, I could bring the air to draw down the third chimney, with such force as to put out a candle. I then lighted a fire in the other chimney; which so rarefied the air in the room, that the incumbent air pressed to enter in, and with a force sufficient to raise a pully with half a hundred weight; and as soon as the room was cooled, by the coming in of the air, the door would shut, and then open again in three minutes.

Having proceeded thus far with good success, I stopped up all the chimneys in the house, the garret excepted, and then lighted two large fires, which

drew the air down the chimney with such violence, as to put out four or five candles immediately : whereupon I concluded, that, a fire being always kept on board a ship, and a pipe or cavity made to the well, one end of it being heated by fire, a change of air would follow, and that by this means rendered sweet and pure, and fit for respiration.

From this time I made it my business to consult the officers and sailors of the navy, who all agreed that such a change of air would be of the greatest use imaginable, in preserving the lives of the men on board his Majesty's ships. I particularly remember, that, being at a coffeehouse near the admiralty, I placed myself nigh some gentlemen of the navy, and inquired of them, as I had before of others, as to the usefulness of the forementioned change of air, who all, to a man, acknowledged that it would be of the utmost service ; and, upon their unanimous approbation of it, I told them that I could procure such a change of air : upon which one of the company went to another table, and the rest followed him ; and I heard him tell the others, that he heartily pitied me, as being really mad, and out of my senses.

Upon this unexpected treatment, I resolved to apply to some person of consequence in the navy, of approved integrity ; and well knowing that Sir Charles Wager was a gentleman of this character, and withal of the greatest humanity, I waited upon Mr Gashery, a commissioner of the navy, and acquainted him that I would communicate my invention to Sir Charles, by word of mouth ; and that if I did not, in a few minutes, convince him of its usefulness, I would withdraw

withdraw immediately, without giving him any further trouble about it.

Mr Gashery was so kind as to speak in my behalf to Sir Charles, and thereupon I was introduced into his presence. I desired Sir Charles to be so good as to permit me to ask him some questions relating to my affair, which he was pleased to permit. I asked him, whether he had ever considered the principles upon which the operations of the cupping-glass were founded? that, rarefaction being made in the glass by means of the fire, and the glass pressed to the skin, the air in the blood presses out the skin; and, the skin being cut, and a second rarefaction made, the blood presses forward to the place where the rarefaction was made. I told him, that in like manner I proposed to procure a change of air on board his Majesty's ships, by means of a fire in the cook-room, and laying proper pipes for that purpose.

Sir Charles, upon my discourse with him about my scheme, not only expressed his approbation of it, but favoured me with the following letter to Sir Jacob Ackworth, surveyor of his Majesty's naval works.

S I R,

THE bearer hereof, Mr Sutton, has found out a method to extract the foul air out of the wells of ships, which will be of great use for preserving the lives of the men aboard his Majesty's ships. He will be willing to talk with you, if an experiment can be made, so that he may not lose the benefit of the invention.

I

I accordingly waited on Sir Jacob, who ordered me to come to him again, five days after, at seven in the morning ; at which time he being engaged in business, I waited at the office till evening, when he was pleased to express himself to me in the following words : “ Sir, I suppose you intend to throw air “ into the wells of ships.” I answered, “ No ; I “ proposed to draw it out by means of fire.” Upon this he asked me, “ if I knew how far I was to draw “ it out ?” I replied, “ Not six inches : for, if I “ could extract it never so small a distance, the incumbent air would press forward of course, and, “ in so doing, cause a constant change.” He admitted this. I then told him, that I waited upon him, by Sir Charles Wager’s orders, in hopes that he would appoint a time for an experiment to be made of my scheme : to which he replied, “ that no experiment “ should be made, if he could hinder it.”

Upon this disappointment, I petitioned the Lords of the Admiralty, and thereby obtained an order from them to the commissioners of the navy, to cause my experiment to be tried on board the Greenwich man of war, then lying at Woolwich. I forthwith carried their Lordships order to Woolwich, and pursuant thereto, to the satisfaction of myself, and all on board the Greenwich, I placed the pipes, and all things necessary for my experiment, except the soldering of two pipes ; but, whilst the solder was hot, and the plumber in readiness to solder them, a messenger from the builder of his Majesty’s yard came to order the workmen ashore. I thereupon repaired to the builder, who acquainted me, that I must apply to the navy-board, to procure an order to have my experiment

ment performed on board the hulk at Woolwich. I instantly replied, that, all the proper preparations being already completed, except the soldering of two joints, which might be done in an hour's time, I desired it might be tried immediately. But to this he made answer, that I must apply to the navy-board, in order that they might procure an order from the Lords of the Admiralty for the trying it on the hulk aforesaid. I thereupon told him, that I insisted on those two joints being soldered, that I might make my report to the Lords of the Admiralty, that I had faithfully executed their order: upon which, he assured me, they should be soldered that very night: but when I went on board the next day, to see if they were soldered, I found them just as I left them the day before.

Finding myself thus disappointed, I took a candle, and went down to the pipes, which were carried through deck, and laid under the beam, towards the well, about thirty feet in length from the copper; and, as soon as I put the candle to the ends of the pipes, they immediately extinguished the flame: which fully convinced those on board of the great usefulness of my invention. But, to my extreme surprise, I no sooner came on shore, than I found, that the master afloat was sent from the King's yard, to take down my pipes, and plug up the holes: upon which, perceiving the obstructions my experiment would meet with, I determined to apply to some gentlemen of the faculty of physic, that were proper judges of the usefulness of my scheme.

Being no stranger to the character of Dr Mead physician to his Majesty, distinguished as much by his
humanity

humanity as his abilities, I went directly to his house, shewed him Sir Charles's letter, and, by his appointment, the next morning came thither again, where I met the learned Martin Folkes, Esq; president of the royal society, whom the Doctor had desired to talk with me, together with himself, upon my proposal. They both expressed their approbation of it, and most readily offered to do whatever was in their power, to encourage an invention which they judged must be of great service to the public. Accordingly Dr Mead immediately waited on the Lords of the Admiralty, and represented to them in a strong manner, the advantage of such a contrivance: whereupon they were pleased to order, that it should be tried as soon as possible, on board any of his Majesty's ships in the river.

Being now left at my own liberty, to chuse a proper place for my experiment, I fixed upon the hulk at Deptford, because that was immoveable, and could not, like a ship, be sent away: and upon this I directly went to Deptford, in order to make the necessary preparations. I was soon acquainted there, that several of the workmen belonging to the King's yard were busily employed in trying the usefulness of another machine, industriously set on foot to supplant mine: but, after the strictest inquiry I have since been able to make, I cannot learn that they had any orders to that purpose from the Lords of the Admiralty.

This proceeding, together with the excessive shyness and caution of the gentlemen of the yard, led me to conclude, that my scheme, at last, would be set aside, in spite of all the steps I could take to prevent it;

It ; and I was confirmed in this opinion, when I found the pipes were made of wood, between five and six inches wide, in such an unworkmanlike manner, that, to render them tight, I was forced to get size and paper from Deptford, to put over the joints ; and that moreover many hands were employed in erecting wind-sails, in order to shew, that they could thereby procure as much air as my scheme would afford.

At length, in September 1741, the day appointed for the trial of the experiment came ; when the Lords of the Admiralty, the Commissioners of the Navy, Dr Mead, Martin Folkes, Esq; and several other members of the royal society, being present on board the said hulk ; Sir Jacob Ackworth was pleased to say, in the hearing of them all : “ I am sorry that “ you are come to see the trial of such a foolish experiment, that I tried myself yesterday, and it would “ not shake a candle.” To this I replied, “ It “ would be in good humour to-day, and the end of “ every one of the pipes would blow out a candle.” And accordingly, notwithstanding the forementioned obstructions, and that the tarpaulins were taken away, which I had ordered to be laid over the hatches, I was as good as my word ; and all the lords and gentlemen aforesaid, upon the trial of my experiment, expressed their approbation of the performance.

In November following I was sent for by the messenger to the Commissioners of the Navy, and by them, pursuant to an order from the Lords of the Admiralty, sent down to Portsmouth, to prepare the Norwich man of war according to my scheme ; and, upon this occasion, Sir Charles Wager, in the presence of the Lords of the Admiralty, honoured me with
the

the following letter to Commissioner Hughes at Portsmouth.

S I R,

Admiralty-office, Nov. 24. 1741.

I Send this by Mr Sutton, who has found out a way to draw bad air out of close places, particularly from wells of ships, which you know are sometimes so bad, as to stifle men before they can be drawn up; as happened on board the Lynn, while I was at Helvoet-Sluys; one man being killed by it, and two narrowly escaped. This contrivance is approved by much wiser men than I am in such things; and therefore I desire you would let Mr Sutton have all the encouragement and assistance you can give him.

I take Mr Alleyn, your builder, to be an ingenious man; if you recommend Mr Sutton to his care, he will see that he meets with no obstruction or discouragement from any body, that may think themselves wiser. There is an order from this board to the navy, from whom you will have it, to have the Norwich, who is to go to the coast of Guinea, to be fitted according to Mr Sutton's scheme; which will be a very good experiment. I am,

S I R,

Your humble servant,

CHARLES WAGER

This letter I carried down to Portsmouth, and delivered to Commissioner Hughes, who received me in a very friendly manner, and recommended me to Mr Alleyn the builder; who both of them (and indeed all the

persons belonging to the yard) exerted themselves to the utmost of their power, to forward my undertaking ; and at length I completed it, agreeable to the plan I shall hereafter exhibit.

Having finished this business, I waited some days at Portsmouth, for a report signed by Admiral Lestock, and several commanders of ships, which Captain Gregory gave me reason to expect : but, at last, (though to do the Captain justice, I must own, that he treated me, whilst at Portsmouth, in an obliging manner), I was acquainted, that no report could be made till the Norwich returned from its voyage ; which was sent to Guinea, and from thence to the West Indies : which constrained me to repent of my journey.

Soon after my return to London, I found things in the utmost confusion, by the sudden change of the ministry, which likewise occasioned a change in the admiralty. I petitioned however the commissioners of the navy, humbly requesting them to make a report of what I had done, from time to time, from the 10th of July to the 10th of December 1741, at Greenwich, Deptford, and Portsmouth, in compliance with the orders of the Lords of the Admiralty ; in order that I might receive a suitable reward for my useful invention, and reasonable satisfaction for my trouble, loss of time, to the neglect of my other affairs, and expenses in the execution of the same. But I received no answer, nor to many petitions I delivered to the Lords of the Admiralty themselves ; until at length, justly moved at the cold and unkind treatment I met with, I freely expressed my sense of their hard usage, in the following petition.

*To the Right Honourable the Lords of the Admiralty,
The petition of Samuel Sutton,*

Humbly sheweth,

THat your Lordships petitioner, having invented an useful scheme, for the extracting foul air out of his Majesty's ships, (which, in the month of September 1741, was tried before the then Lords of the Admiralty, who approved the performance), lately applied to your Lordships; but, to his extreme surprize, he finds, that he is not likely to receive any reward, either for the invention itself, or his loss of time and expenses: nor are his Majesty's sailors and mariners likely to receive any benefit from his scheme; though it is universally acknowledged, that more of them have lately died in America, for want of good air, than by the Spaniards. That your Lordships petitioner cannot help remarking, that, though no invention ever met with more applause from the public than this, never was any man (himself excepted) employed by the Lords of the Admiralty, from time to time, at his own charges, as he has been, without a proper consideration. That your Lordships petitioner now desires, that you would be pleased to consider him on that account, and order him a suitable satisfaction; and as in duty bound for your Lordships, he will ever pray.

This petition was overlooked like the rest, nor was there any notice taken by the Lords, either of me or my scheme, till Captain Gregory returned to London; who, soon after his arrival, sent a letter to the then
Lords

Lords of the Admiralty, in reference to the Norwich man of war, which I fitted up at Portsmouth; and the following extract of it was left at their office for me.

Extract of a letter from Captain Gregory, late commander of his Majesty's ship the Norwich, to Mr Corbett, dated June 11. 1743.

AS to the air-pipes which were put on board of me, I was obliged to stop up two of them, by reason the fire came down between decks: the other to the well was kept open; but the ship making water enough to keep her sweet, I was not able to judge of their use, having been so healthy as to bury only two men all the time I was on the coast.

Copy, THO. CORBETT.

I have many remarks to make upon this letter, which by no means can be justly called a report, since the other officers of the ship were not consulted; particularly the surgeon, and the carpenter, or other under-officers, the most competent judges; the former, of the health of the men; and the latter, of the sweetness and good condition of the provisions. As to Mr Haddon the carpenter, who had been several voyages to Guinea before, and never knew the like; he assured me, that the provisions continued entirely sound, and the men healthy, free from the scurvy, or any other disorder, to the admiration of the people of Barbadoes, who there questioned, whether they had been at Guinea, or no: and indeed, this matter

of fact, which is the main point, is for substance acknowledged by the Captain himself; though, at the same time, he is pleased to say, "that he was not able to judge of the use of my pipes." This gentleman, it seems, lost so few men that he could not discover the usefulness of my pipes; but, had he lost the greatest part of his crew, I dare say, that he would have been able to judge that my pipes were of no service at all. But, though the extract of the Captain's letter carries its own confutation along with it; yet, as it was sent to the Lords of the Admiralty, I thought it expedient to give an answer to it, in the following letter to the Earl of Winchelsea.

My LORD,

THough I have petitioned the Right Honourable the Lords of the Admiralty several times, and even wrote your Lordship, in reference to my extracting foul air out of his Majesty's ships, and never received any answer, except an extract from Captain Gregory's letter; yet, in justice to my scheme, I apprehended myself obliged to lay before your Lordship some just remarks on the said extract, which I hope will effectually remove any inferences that may be thence drawn to the prejudice of my useful invention, which is founded on the most evident principles, and may be put in execution, at so easy a charge as about thirty pounds, in any of his Majesty's ships. As to the Captain, he says, that he was obliged to stop up two of my pipes, by reason some sparks of fire came down between the decks. But this might easily have been prevented, by adding
two

two pipes of tin (which they never want), three feet long, and bringing them through the chimney, by which all communication would be cut off between those sparks and it. The Captain also declares, that he could not tell, whether the pipe to the well, because of the water in it, was of use or not; but, which seems to be very unfair dealing, he entirely overlooks two other pipes. I entreat your Lordship to be pleased to consider, that the pipes draw more air than any kitchen-chimney, and what is sufficient to sweeten any ship in the navy. The Captain himself owned to me, that not so much as one of his Majesty's ships heretofore, or that, out of such a number, so few have lost their lives, and so many have returned in perfect health from such a voyage: and indeed, if my scheme was generally put in practice, this, in all likelihood, would become a common case, nor would ships that come from infected places, have any occasion to perform quarantine, the air being preserved, by the foresaid pipes, in a pure and wholesome state. I am,

My LORD, &c.

And as the principal, and indeed only, objection, in the extract against my scheme, was the danger of fire; I wrote the following letter to Sir Jacob Ackworth, his Majesty's surveyor, in order to shew, that it was entirely groundless.

Honoured SIR,

When a scheme is proposed for the good of mankind in general, and the preservation of the lives of his Majesty's subjects in particular; it is doubtless highly reasonable, that, as it is a matter of great consequence and importance, a strict inquiry should be made, whether it be practicable, and will effectually answer the end proposed. As to the inconveniency apprehended to attend mine, that it will expose ships to the danger of fire, I entreat you to be so good as to inquire of any bricklayers, or builders, whether this apprehension be not entirely groundless. I could heartily wish that you would be pleased to satisfy yourself in this particular: as your declaration, on this point, in my favour, would have great weight with the Lords of the Admiralty; in order to my being by them appointed to have the direction of laying pipes on board his Majesty's ships. I am, Sir, firmly relying on your goodness,

Your humble and obedient servant,

SAMUEL SUTTON.

Soon after, when the plague raged in Sicily, and timely precautions were taken to prevent its being introduced hither, I again wrote to the Earl of Winchelsea as follows.

My

My LORD,

A Proclamation being issued out for ships to perform quarantine, I humbly beg leave to acquaint your Lordship, that if my scheme for extracting of foul air was properly put in practice on board such ships, it would effectually preserve the health and lives of his Majesty's subjects. And, such a fume being let down as the physicians may judge expedient, great advantages would arise, without any ill consequences whatsoever : because, the foul air being consumed by the fire, the fume, by means of a pipe let into the hold of the ship, will with ease be drawn down, there being a want of it to supply what is extracted. If your Lordship will be pleased to consult the physicians, you will find that what I offer is practicable, being founded on just and rational principles. I am,

My LORD,

Your humble and obedient servant,

SAMUEL SUTTON.

Sir Jacob Ackworth, Mr Alleyn of Deptford, and the rest of the surveyors will readily attest, that no damage can arise from the fire made use of in my scheme ; which is the only objection that has hitherto been advanced against it.

Having thus refuted the foresaid objection, and I hope in a convincing manner, it was natural for me to expect, without any longer delay, a reward suitable

ble to the importance and usefulness of my invention ; but it was some time after this, before I received the following order from the Lords of the Admiralty.

Extra.

Received the 31st Oct. 1743.

N^o 688.

Mr TREASURER,

N^o ^{2619.}
1743. **I**N pursuance of an order from the Right Honourable the Lords Commissioners of the Admiralty, dated 22^d October 1743, signifying, that, whereas Mr Samuel Sutton did, some time since, propose to that board an invention of his, for extracting the foul air out of ships by fire, and letting in fresh air, an experiment of which was ordered to be made on board his Majesty's ship the Norwich, bound to the coast of Africa ; and Captain Gregory, who commanded the said ship, having since his return made a report thereof, a copy of which their Lordships sent us therewith, whereby it appears, that it does not, in all respects, come up to the expectation, and that the use thereof is dangerous, and liable to accidents by fire : yet, as the said Mr Sutton has employed a great deal of pains and time about the said invention, for the benefit of the navy, and had encouragement from their Lordships so to do ; and their Lordships being desirous to give encouragement to persons who shall turn their thoughts to any inventions that may tend to the advantage of the navy, do thereby desire and direct us to cause a bill of one hundred pounds to be made out to the said Samuel

muel Sutton, as a reward for the loss of time and expenses he has been at about the said invention.

We pray you to pay unto Mr Samuel Sutton accordingly, the sum of one hundred pounds. Dated 22d Oct. 1743.

J. B.

31 Oct. 1743.

JAM. COMPTON—Ca. Account.

RICH. HADDOCK.

J. B.

N^o 2360. }
359 }

This, Sir, was all the satisfaction I could procure from the Lords of the Admiralty, though I had, from time to time, executed their orders with the utmost fidelity, and even that, not till above two years after the trial of my first experiment on board the hulk at Deptford: a satisfaction that scarcely defrayed my expenses. But I am persuaded, from what has been already said, you clearly perceive, that, as matters stood, if the usefulness of my scheme had appeared in the most demonstrative light, I should, after all, have fallen short of a suitable reward; and indeed this is the truth of the case. Dr Hales's ventilators, which were designed to answer the same purposes as my pipes, had, by some means or other, got such an ascendant in the esteem and regard of some leading persons in the affairs of the navy, as, in spite of conviction itself, to admit of nothing to come in competition with them; though even that darling scheme is now out of date and exploded. Far be it from me,

to

to insult and triumph over a conquered adversary : and it is needless, as well as cruel, to spend much time in confuting a scheme, that experience has abundantly shewn to be absurd and ridiculous. However, I think it incumbent on me to observe, how much I was surpris'd to find no mention made by the candid author of the Description of ventilators, of my invention : whereas he himself saw an experiment made before the royal society with a model of it, and heard Dr Mead's account of it read to that learned body ; which account was published in the Philosophical Transactions some time before the book of ventilators was printed. Upon the whole, this is a peculiar advantage attending my invention, that its beneficial influences are perpetual, without the least intermission ; whereas Dr Hales fully evinces the insufficiency of any attempts to make the air in ships wholesome, by only a few hours ventilation. " It were to be wished," (says he, p. 41.), " that there should not be so much " as one hour without ventilation, when the ports are " shut." His ventilators are cumbersome machines, taking up more room than can conveniently be spared, and require many hands to work them : my pipes take up no room, but what may be very well spared, and stand in need of no manual labour at all. His ventilators have only a casual and uncertain, but my pipes a certain and uninterrupted effect. His ventilators cannot extract the air from the well at the bottom of the ship ; but mine do this, and introduce pure and wholesome air, in the place of impure and unwholesome. His ventilators, he tells us, will keep a prison sweet ; but my pipes will sweeten even a bog-house, and may be convey'd miles under ground
into

into the deepest mines and subterraneous cavities, with the same success. His ventilators require much more air than my pipes, which will admit of more or less, as shall be thought expedient. And as my scheme, in all these respects, surpasses his ; so his is dead and buried, without any hope of a resurrection, whilst mine rises in its reputation daily : and the report of Captain Comyns, commander of the Fame privateer, which I fitted up some months ago, and which is returned to Lisbon with his crew in health and vigour, will give such an ample and satisfactory attestation of the safety and usefulness of my pipes, as will be sufficient to dispel the doubts and suspicions of the most incredulous.

To conclude : the simplicity of this machine ; its easy stowage without being cumbersome ; its operation without any labour to the seamen ; the small expense to put it in execution, and maintain it ; besides its tendency to preserve the health and lives of the seamen, to keep the ship dry, and the merchandise from damaging ; are strong reasons why no ship should go to sea without it. I am,

Sir, Yours, &c.

SAMUEL SUTTON.

An

An account of Mr Sutton's invention and method of changing the air in the hold and other close parts of a ship ; communicated to the royal society by Richard Mead, M. D. physician to his Majesty, fellow of the royal society, and of the royal college of physicians, London.

Read Feb. 11. 1741-2.

IT is found by daily experience, that air shut up and confined in a close place, without a succession and fresh supply of it, becomes unwholesome, and unfit for the use of life.

This is more sensibly so, if any stagnating water be pent up with it.

But it grows still worse, if such an air as this is made use of in respiration, that is, becomes moister and hotter, by passing and repassing through the lungs.

These bad effects, in different degrees, according to the different manner in which air is inclosed, are observed in many cases ; particularly in deep wells and caverns of the earth, in prisons or close houses, where people are shut up with heat and nastiness : but most of all in large ships, in which, with the stench of water in the hold, many men being crouded up in close-quarters, all the mentioned circumstances concur in producing greater mischief, than would follow from any of them single.

The reason of these bad effects is this : it is that property

property of the air which is called its elasticity or springiness, which makes it so useful to our life. When any part of it is inclosed and kept from the communication of the outward air, it expands itself, and, in proportion to the closeness of the place, loses its spring; and if any heat or moisture comes to it, the elastic force may be quite lost and destroyed. And not only so, but if it happens to be impregnated with noxious effluvia, either from unwholesome substances of any kind, or from the infectious breath of diseased bodies; it will become quite poisonous and deadly, in a manner suitable to the original cause.

It is proposed at present to find out a remedy for this evil in ships only: but by making alterations, according as particular places require, the same may be applied to any houses or parts of them, as prisons, the sick wards in hospitals, &c.

Now, it is a natural consequent of the elasticity of the air, that when it is rarefied in any part, (which is most effectually done by heat), the neighbouring air will rush that way, till this part is brought to be of an equal density and elasticity with itself; and this again will be followed by the air next to it; so that, if a conveyance for air be laid from the hold or well of the ship, and a rarefaction of the air therein be made; the foul air from this place will run or be drawn out that way, and fresh air from the adjacent parts will succeed in its room.

It is upon these principles that the following scheme is most humbly offered to the Right Honourable the Lords of the Admiralty, and Commissioners of the Navy, which it is hoped will be found effectual for clearing the bad and corrupted air from the holds,

and other close parts of his Majesty's ships; and thereby prove beneficial to the public, by preserving the healths of many of his Majesty's good subjects serving on board the same; the whole thing being indeed easy to be executed, and that will no way incumber, or be troublesome, in any of the vessels where it shall happen to be applied: the same being, in short, no more than this: that whereas, in every ship of any bulk, there is already provided a copper or boiling-place proportionable to the size of the vessel; it is proposed to clear the bad air by means of the fire already used under the said coppers or boiling-places, for the necessary uses of the ship.

It is well known, that, under every such copper or boiler, there are placed two holes, separated by a grate; the first of which is for the fire, and the other for the ashes falling from the same; and that there is also a flue from the fire-place upward, by which the smoke of the fire is discharged at some convenient place of the ship.

It is also well known, that the fire once lighted in these fire-places, is only preserved by the constant draught of air through the forementioned two holes and flue; and that if the said two holes are closely stopped up, the fire, though burning ever so briskly before, is immediately put out.

But if, after the shutting up the above-mentioned holes, another hole be opened, communicating with any other room or airy place, and with the fire; it is clear, the said fire must again be raised and burn as before; there being a like draught of air through the same, as there was before the stopping up of the first holes: this case differing only from the former

in

in this, that the air feeding the fire, will now be supplied from another place.

It is therefore proposed, that in order to clear the holds of ships of the bad air therein contained, the two holes above mentioned, that is, the fire-place and ash-place, be both closed up with substantial and tight iron doors; and that a copper or leaden pipe, of sufficient size, be laid from the hold into the ash-place, for the draught of air to come in that way to feed the fire. And thus it seems plain from what has been already said, that there will be from the hold a constant discharge of the air therein contained; and consequently, that that air so discharged must be as constantly supplied by fresh air down the hatches, or such other communications as are open into the hold: whereby the same must be continually freshened, and its air reedered more wholesome, and fit for respiration.

And if into this principal pipe so laid into the hold, other pipes are let in, communicating respectively either with the well or lower decks; it must follow, that part of the air consumed in feeding the fire, must be respectively drawn out of all such places, to which the communication shall be so made.

T O

MARTIN FOLKES, Esq;

President of the Royal Society.

S I R,

According to my promise, I have herewith sent you my observations upon Mr Sutton's machine, which I drew up some time since, and intended to lay before the royal society in December last, before I knew either that a model would be shewn by Mr Sutton, or that Dr Mead would have presented his account thereof. I am conscious of the disadvantages my slender performance must appear under after the reading of one upon the same subject from so celebrated a pen as Dr Mead's.

These remarks were the result of several times seeing the machine, when first put in execution at Deptford. I hope it will not take up too much of the society's time to read my paper this evening, and am,

S I R,

Your most obedient humble servant,

Aldersgate-street,
Thursday morning,
April 1. 1742.

W. WATSON.

Some

Some observations upon Mr Sutton's invention to extract the foul and stinking air from the well and other parts of ships, with critical remarks upon the use of wind-sails, by William Watson, F. R. S.

London, Dec. 4. 1741.

Read April 1. 1742.

AS nothing is more conducive to the health of the human body, than the taking a sufficient quantity of wholesome air into the lungs; so the contrary is attended with pernicious and often with destructive consequences.

One of the great uses of air in inspiration is to cool the blood passing through the lungs, where nature has provided, according to the excellent Malpighius, that the blood should be distributed through a vast number of exceedingly fine arteries, which occupy the thin vesicles of the lungs; and by this means the blood is exposed to the air under a prodigiously large surface, whereby the putrefaction is prevented, which, from the alcacescent quality of that fluid, would otherwise be speedily destructive.

Observations inform us, that contagious distempers are more frequent in hot climates than in cold; and in closely-built cities full inhabited, than in towns: the former may, in some measure, proceed from the too great heat of the air, not fully answering the above-mentioned purposes; and the latter from too

many people breathing in the same atmosphere, thereby rendering it unfit for respiration.

It has been frequently tried, that if a gallon of air be contained in a bladder, and, by means of a blow-pipe, inspired and expired into the lungs of a man, without having any communication with the external air ; in the space of a minute, or little more, it becomes heated, and unfit for respiration ; and without the addition of fresh air, the person making the experiment would speedily be suffocated. The diving-bell is another instance of the same kind, wherein a constant supply of fresh air must be had, to keep out the water, and refresh the people included.

Although air is absolutely necessary to our existence, and necessity constrains us inevitably to breathe therein, it may be made a vehicle of most malignant poisons, as witness the famous Grotto del Cani in Italy, the poisoning air by charcoal, and air impregnated with the fumes of fermenting vegetable liquors. Stagnant air, either alone or mixed with water, soon becomes very offensive and pernicious ; as in wells dug for the supply of water, and disused for some time ; as is the air also in the wells and in the holds of ships, which is occasioned principally by what is usually called the bulge-water, which, if the ship is tight, and not frequently pumped, becomes not only very offensive, but so extremely poisonous, as frequently to suffocate those seamen, who, as the pumps are subject to be clogged with filth, venture down to cleanse them ; and will cause also in persons at a distance violent head-achs, cold sweats, and frequent vomitings, which continue more or less, in proportion to the distance from the well of the ship, when

when the injury was received, and the degree of putrefaction in the water and air.

The air, in ships particularly, is very liable to be vitiated, not only from the bulge-water, but from too many people breathing in the same atmosphere; especially in ships of war, hospital-ships, and those used in the Guinea trade for negroes; where a number of uncleanly people, being stowed too close together, heat the air, make it replete with noxious effluvia, destroy the particles therein adapted to cool the lungs, particularly the acid nitrous gas. This principle is abundant in cool air, and manifests itself not only from the quantity of nitrous crystallizations, which may be collected from caverns of the earth, especially those open to a northerly aspect, but also from exposing pieces of the flesh of animals fresh cut, or their blood, whereby the colours of their surfaces are soon changed from a dark deep red to a more lively and florid one. Air robbed of this valuable property, and replete with hurtful ones, not only from the people, but from the stinking water in the well and lower parts of the ship, must produce the most putrid, if not pestilential fevers.

Although the æquilibrium within places confined is maintained by the external air, yet unless, by openings properly adapted, the air is suffered to pass freely enough, the external air proves as a stopple to the internal, and only mixes with that portion of it which is next in contact: this is evident from the common occurrence in privies, which are scarcely offensive in clear weather, but are much so in foul or windy, from a diminution of the incumbent pressure of the atmosphere,

atmosphere, when the vapours that have been pent up, expand themselves to a considerable distance.

To prevent the above-mentioned inconveniencies, and to preserve the healths and lives of the seamen, that valuable part of the nation, many schemes have been thought of; particularly the machines of those two very worthy, ingenious, and industrious members of this society, the Rev. Dr Hales, and the Rev. Dr Defaguliers; the first by an instrument which he calls the ship's lungs *, and the latter by a machine †, which is an improvement of the Hessian bellows; but as these have been laid before the society by the gentlemen themselves, I shall pass them over, and proceed to mention the contrivance commonly made use of, I mean the wind-sails. They are made of the common sail-cloth, and are usually between 25 and 30 feet long, according to the size of the ship, and are of the form of a cone ending obtusely; when they are made use of, they are hoisted by ropes to about two thirds or more of their height; with their basis distended circularly by hoops, and their apex hanging downwards in the hatchways of the ship; above each of these, one of the common sails is so disposed, that the greatest part of the air, rushing against it, is directed into the wind-sail, and conveyed, as through a funnel, into the upper parts of the body of the ship. These must be hung up and taken down every time they are used, and the supply by this method is not constant. Though custom has given a sanction to this device, it is subject to many inconveniencies. 1/2, Each ship having commonly

* See Dr Hales's treatise of ventilators.
Philos. Trans. N^o 437.

† See
three

three of these, (one to each mast), the seamen are a considerable time in getting their apparatus ready, and in hoisting them up to make use of. *2dly*, They can only be used in mild weather. *3dly*, Near the equator, where fresh air is most wanted, there sometimes happen such stark calms, that they are useless, by not having air enough to distend them. *4thly*, The air hereby admitted passes only into the upper and more open parts of the ship, so that the well, &c. receive no change therefrom; and it is observed, that sometimes, upon using them after some discontinuance, they drive offensive air into the cabin, and more airy parts of the ship: like as the pouring some fresh into stinking water makes the whole stink, though in a less degree. *5thly*, They are improper to be used in the night-time, when the people are sleeping between decks. And lastly, admitting they had none of the former inconveniencies, their use must be destructive in hospital-ships; where, though fresh air imperceptibly received, is absolutely necessary to preserve the crew as free as possible from the infectious breath and exhalations of the diseased and wounded seamen; yet blasts of wind, pouring impetuously into the very places where the sick lie, must be attended with such consequences as are too obvious to mention.

To remedy these inconveniencies, to prevent the air proving foul even in the wells and holds of ships, and to cause imperceptibly a large circulation of fresh air into every part of the ship at all times, Mr Sutton has invented the following scheme, which is useful not only in these cases, but, by altering some parts as particular places require, may be applied to houses,

houses, the close parts of prisons, wells at land, privies, hospitals, &c.

Nothing rarefies air so considerably as heat, which whenever it causes a diminution in the density of the air, that part next in contact will rush in, and be succeeded by a constant supply, till the air becomes of an equal degree of elasticity. Therefore, if a tube be laid in the well, hold, or any other part of the ship, and the upper part of this tube be sufficiently heated to rarefy the impending column of air, the æquilibrium will be maintained by the putrid air from the bottom of the tube, which being drawn out this way, a supply of fresh air from the other parts of the ship will succeed in its place; which operation, being continued, will entirely change the air in all parts of the ship. This principle, exactly conformable to the doctrines of pneumatics, is the basis of Mr Sutton's machine, which being put in execution on board the hulk at Deptford, before the Lords of the Admiralty, Commissioners of the Navy, our very learned and ingenious President, M. Folkes, Esq; Dr Mead, &c. performed to their satisfaction, in bringing air from the bread-room, hold, and well of the ship at the same time, in such quantity, that large lighted candles being put to the end of the tubes, the flame was immediately sucked out as fast as applied, though the end of one of the tubes was above twenty yards distant from the fire. The method is as follows.

To boil the provisions of the ship's company, they must have a copper, which is bigger or less, in proportion to the size of the ship, and number of the crew; this copper is fixed in ships in the manner as

on land, having under it two openings divided by an iron grate. The first opening, having an iron door, is for the fire; the ashes from the grate drop through into the bottom of the other; the smoke passes through a chimney, and is discharged as usual. After the fire is lighted, it is supported by the air from the parts next the ash-pit; but having, contrary to the usual custom, adapted an iron door, like the former, made very tight, to prevent the ingress of air, the fire would soon be extinguished, if not supplied by some other aperture: in order to which, one or more holes are made through the brick-work in the side of the ash-pit; and tubes of lead or copper, fitted closely in the holes, and made fast, are laid from thence into the well, and other parts of the ship; by which means the air next the bottom of the tubes rushes through them, and the foul and stinking air succeeding is transmitted through the fire, and passes off, without offending, by means of the chimney; and a supply of fresh air from the other parts of the ship continually fills the place of the former, the fire requiring a constant support. This support will not be wanting, not only during the continuance of the fire, but while any warmth remains in the fire-place, copper, or brick-work, as was observed on board the hulk at Deptford, where the draught of air through the tube lasted above twelve hours after the fire was taken away. This being considered, as the dressing the provisions for a number of people will take up some hours every day, the warmth of the brick-work and flues will continue a draught of air from one day to the next. Mr Sutton proposes thus to circulate the air by the same, and

no greater expense of fire than is customarily used for the necessities of the ship.

The operation of the machine will be equally useful in large as in small ships; for the greater the number of people they have on board, the larger quantity and longer continuance of the fire will be necessary to dress the provisions; and therefore there will be required a greater quantity of air to support that fire. The size and number of the tubes need not be specified; because as the circulation of air is in proportion to the quantity of fire; the wider the tube, and greater the number of them, the less the velocity of the air, and *vice versa*.

I several times took notice in this machine, when, for the sake of observation, after the fire was well lighted, the lowest iron door was left open, that the flame did not ascend so high, or burn so fierce; but immediately upon shutting thereof, when the draught of air was only through the tubes, the flame soon recovered its former vigour.

There is likewise, especially in large ships, not only a copper, but also a fire-grate like those used in kitchens: that the heat and smoke of this also may not be useless, an iron tube may be fixed behind the grate, and inserted quite through the brick-work, and through the deck, so that one end thereof will stand about a foot, or little more, in the chimney above the brick-work, and the other will enter into the hold, or any other part of the ship; the upper end of this tube then being heated, the draught of air will be supplied from below, as in the other case. This likewise was tried on board the hulk, with an iron tube about two inches and an half in diameter, and the
lighted

lighted candles held at the bottom of this tube were extinguished as fast as by any of the others.

It may be objected, that a number of tubes take up too much room, especially in merchant-ships, and are subject to be broken or injured by loading or unloading: to remedy which, it is adviseable, that only one tube of a convenient size be made fast unto the side of the ash-pit, and, as soon as it comes through the main deck, to compress it (a circular or any other form being equally useful) not too close; and it may be divided into as many ramifications as may be thought necessary, (especially as the bread-room, store-room, &c. cannot be kept too sweet, a branch for each of these); and these branches may be carried between the beams which support the deck, till they come to the side of the ship, and there be let down likewise between the beams into the places intended; by which contrivance their operation will not in the least be obstructed, and the tubes be secured from any accident.

The simplicity of this machine, it being so little cumbersome, its operation without any labour to the seamen, the small expense to put it in execution, and maintain it, besides the forementioned considerations, are other arguments for its general use.

Continuation of the historical account of a new method, &c.

S I R,

SINCE my first letter to you, giving an historical account of my method for extracting foul air out of ships, &c. I have made such improvements in it,

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X

that

that I am convinced it is now perfect, and will produce all the benefits that can be expected from a free circulation of fresh air in close places; without any of those imaginary inconveniencies, that by some few were apprehended from it. And my conviction does not arise from the truth of the principles alone, on which it is founded; but likewise from impartial experiments made with my machine during long voyages in several parts of the world; and ample testimonials of its salutary effects, wherewith I have been honoured; the most material of which you will find at the foot of this letter.

I have now the satisfaction to inform you, that my invention has at length surmounted all obstacles through the wisdom and zeal of the present Right Honourable the Lords of the Admiralty, and the Right Honourable and Honourable the principal officers and commissioners of his Majesty's navy, who, having taken the whole affair into their serious consideration, were so thoroughly satisfied of the great advantages that must accrue to the nation from the faithful execution of my scheme; that the said principal officers and commissioners of his Majesty's navy have contracted with me for fixing my engine on board his Majesty's ships, whether laid up, or in commission: for which act of general concern, as I well know the warmth of your heart for the good of our country, I doubt not but you will readily concur with me in making cordial acknowledgments to their Lordships, and those Honourable gentlemen in the name of the public.

Yours, &c.

SAMUEL SUTTON,

Extract

Extract from Lord Anson's voyage, 4to
edit. p. 36. shewing the want of an en-
gine to extract the foul air.

THE Captains of the Squadron represented to the
Commodore, that their ships companies were
very sickly, and that it was their opinion, as well as
their surgeons, that it would tend to the preservation
of the men to let in more air between decks; but
that their ships were so deep, they could not possibly
open their lower ports. On this representation, the
Commodore ordered six air-scuttles to be cut in each
ship, in such places where they would least weaken it.

And on this occasion I cannot but observe, how
much it is the duty of all those, who, either by office
or authority, have any influence in the direction of
our naval affairs, to attend to this important article,
the preservation of the lives and health of our seamen.
If it could be supposed, that the motives of humani-
ty were insufficient for this purpose; yet policy, and
a regard to the success of our arms, and the interest
and honour of each particular commander, should na-
turally lead us to a careful and impartial examination
of every probable method proposed for keeping a
ship's crew in health and vigour. But hath this been
always done? Have the late invented plain and obvious
methods of keeping our ships sweet and clean, by a
constant supply of fresh air, been considered with that
candour and temper which the great benefits promised
thereby ought naturally to have inspired? On the
contrary, have not those salutary schemes been often
treated with neglect and contempt? And have not

some of those who have been intrusted with experimenting their effects, been guilty of the most indefensible partiality, in the accounts they have given of these trials? Indeed, it must be confessed, that many distinguished persons, both in the direction and command of our fleets, have exerted themselves on these occasions with a judicious and dispassionate examination, becoming the interesting nature of the inquiry; but the wonder is, that any could be found irrational enough to act a contrary part, in despite of the strongest dictates of prudence and humanity. I must however own, that I do not believe this conduct to have arisen from motives so savage, as the first reflection thereon does naturally suggest: but I rather impute it to an obstinate, and in some degree superstitious, attachment to such practices as have been long established, and to a settled contempt and hatred of all kinds of innovations, especially such as are projected by landmen, and persons residing on shore.

Testimonials of the advantages and success of
my machines for purifying the air in ships,
and other close places.

N U M B. I.

*Extract of a letter from Rear-Admiral Boscaawen to
Mr Corbett, dated in Table-bay, 9th April 1748.*

THE squadron, as well as the troops, who are with me, are surprisngly healthy, and have been so in general our whole passage: which I attribute in a great measure to our having touched at the islands, where I procured refreshment.—But at the
same

same time I cannot help thinking, the air-pipes fixed in the men of war have been of great service in this particular, by purifying the air between decks, and thereby preventing the scurvy.

In addition to what I have said above of the air-pipes, I cannot help observing to their Lordships, that the bulge-water on board the *Namur* in particular, has not been the least offensive the whole passage; though it was so bad when we last went into Portsmouth harbour, that three or four men were like to be suffocated, by only coming near the well; and therefore I cannot but recommend them as things highly useful on board his Majesty's ships.

N U M B. II.

MR Joseph Hatton, carpenter of the *Warwick* man of war, during her voyage to Guinea, and the West Indies, mentioned above, p. 211. declared at the navy-board, that on the accident of breaking the chain of their pump, it fell with a kink in the chain, so that it could not be got up or down; wherefore he was obliged to go into the well, in order to cut a scuttle in the pump to clear the kink: that he remained in the well near five hours in a considerable depth of water, without any ill effect on his health; which he imputes to the pipes being fixed on board the said ship, for extracting the foul air.

N U M B. III.

Captain Petre, commander of the *Sandwich*, in the service of the East-India company, on board of which Mr Sutton had constructed one of his machines,

machines, declared at the navy-board, that on his return from a China voyage in 1747, when he put in at Ireland, he ordered some of the bulge-water to be brought up; and it differed not in smell from other common sea-water, but differed in colour as the liquor of bohea from green tea.

N U M B. IV.

Extract of a letter from Captain William Lisle, commander of his Majesty's ship the Vigilant, at the Cape of Good Hope, April 10. 1748.

I Gave you an account of all that occurred till I left Madeira, in a letter from thence: however, that you may form a better idea of the tedious passage to this place, I shall just mention the dates of our departure from the several ports we touched at in our passage. We left Spithead the second of November, Lisbon the twenty-fourth of January, and arrived at the Cape of Good Hope the twenty-second of March; by which you may observe, that our passage from Madeira to this place was just eleven weeks, and our whole voyage from England full five months, if we fix each month at twenty-eight days: which is a long time to be getting but little more than half-way to our journey's end; but though long, yet it has been attended with very few bad circumstances: and particularly in regard to the health of the several ships companies, and all the troops in general, never were people more healthy; which I cannot but suppose is entirely owing to the new-invented ventilators*, and

* N. B. These are Mr Sutton's air-pipes.

the large quantity of mustard-seed allowed by the government to the seamen by way of experiment. The Dutch who reside here, speak of it as a miracle, and make it the chief subject of their conversation.

An abstract of the letters patent, granted by his Majesty, for the aforesaid invention.

GEORGE the Second, by the grace of God, of Great Britain, France, and Ireland, King, Defender of the faith, &c. To all to whom these presents shall come, greeting. Whereas our trusty and well-beloved Samuel Sutton, of our city of London, brewer, hath, by his petition, represented unto us, that he has, after long study, much pains, great expense, and repeated experiments, found out, and brought to perfection, a new invention or method for extracting foul air out of ships by means of fire, and will equally contribute to the removing of all noxious air whatsoever, and may be conveniently applied to mines and caverns in the earth, dungeons, prisons, and all infected places; that the said invention may be used in hot-houses and walls, which will greatly warm the earth, for the speedy production of its fruits, and also in granaries for the preservation of corn and grain; that the said invention will greatly tend to the preservation of the lives of great numbers of our subjects, and be of public use and benefit to this our kingdom in general: and as the petitioner is the first and sole discoverer of the said invention, or method, and also, in regard to the great expense of money and time the petitioner has sustained, in making so valuable a discovery; he

he therefore most humbly prays us, that We would be pleased to grant him our royal letters patent, for the sole use and benefit of his said new invention, within that part of our kingdom of Great Britain called England, and the dominion of Wales, and town of Berwick upon Tweed, and in our plantations in America, for the term of fourteen years, according to the statute in such case made and provided : We being willing to give encouragement to all arts and inventions, which may be for the public good, are graciously pleased to condescend to the petitioner's request. Know ye therefore, that We, of our especial grace, certain knowledge, and mere motion, have given and granted, and by these presents, for us, our heirs and successors, do give and grant unto the said Samuel Sutton, his executors, administrators, and assigns, our especial licence, full power, sole privilege, and authority, that he the said Samuel Sutton, his executors, administrators, and assigns, and every of them, by himself, and themselves, or by his and their deputy or deputies, servants or agents, or such others as he the said Samuel Sutton, his executors, administrators, or assigns, shall at any time agree with, and no others, from time to time, and at all times hereafter, during the term of years herein expressed, shall and lawfully may make, use, exercise, and vend his said invention, within that part of our kingdom of Great Britain called England, our dominion of Wales, and town of Berwick upon Tweed, and our colonies and plantations in America, in such manner, as to him the said Samuel Sutton, his executors, administrators, and assigns, or any of them, shall in their discretions seem meet : and that the said Samuel Sutton,

ton, his executors, administrators, and assigns, shall and lawfully may have and enjoy the whole profit, benefit, commodity, and advantage, from time to time, coming, growing, accruing, and arising, by reason of the said invention, for and during the term of years herein mentioned; to have, hold, exercise, and enjoy the said licence, powers, privileges, and advantages herein before granted, or mentioned to be granted, unto the said Samuel Sutton, his executors, administrators, and assigns, for and during, and unto the full end and term of fourteen years, from the date of these presents, next and immediately ensuing, and fully to be complete and ended, according to the statute in such case made and provided. And to the end that he the said Samuel Sutton, his executors, administrators, and assigns, and every of them, may have and enjoy the full benefit, and the sole use and exercise of the said invention herein before declared; We do by these presents, for us, our heirs and successors, require, and strictly command all and every person, and persons, bodies politic and corporate, and all other our subjects whatsoever, of what estate, quality, degree, name, or condition soever they be, within that said part of our kingdom of Great Britain, called England, our dominion of Wales, and town of Berwick upon Tweed, and our colonies and plantations in America aforesaid, that neither they, nor any of them, during the continuance of the said term of fourteen years hereby granted, either directly or indirectly, do make, use, or put in practice the said invention, or any part of the same so attained unto by the said Samuel Sutton as aforesaid, nor in any wise counterfeit, imitate, or resemble the same, nor shall make,

or

or cause to be made, any addition thereunto, or subtraction from the same, whereby to pretend himself, or themselves the inventor or inventors, deviser or devisors thereof, without the licence, consent, or agreement of the said Samuel Sutton, his executors, administrators, or assigns, in writing under his or their hands and seals, first had and obtained in that behalf, upon such pains and penalties as can or may be justly inflicted on such offenders, for their contempt of this our royal command; and further, to be answerable to the said Samuel Sutton, his executors, administrators, and assigns, according to law, for his and their damages thereby occasioned. And moreover we do by these presents, for us, our heirs and successors, will and command all and singular the justices of the peace, mayors, sheriffs, bailiffs, constables, headboroughs, and all other officers, and ministers whatsoever of us, our heirs and successors, for the time being, that they or any of them do not, nor shall at any time hereafter, during the said term hereby granted, in any wise molest, trouble, or hinder the said Samuel Sutton, his executors, administrators, or assigns, or any of them, or his, or their deputy, servants, or agents, in or about the due and lawful use or exercise of the aforesaid invention, or any thing relating thereto.

And lastly, We do by these presents, for us, our heirs and successors, grant unto the said Samuel Sutton, his executors, administrators, and assigns, that these our letters patent, or the inrolment or exemplification thereof, shall be in and by all things good, firm, valid, sufficient, and effectual in the law, according to the true intent and meaning thereof, and shall
be

be taken, construed, and adjudged, in the most favourable and beneficial sense, for the best advantage of the said Samuel Sutton, his executors, administrators, and assigns, as well in all our courts of record as elsewhere, and by all and singular the officers and ministers whatsoever of us, our heirs and successors, in that part of our said kingdom of Great Britain called England, or dominion of Wales, and town of Berwick upon Tweed, and our colonies and plantations in America aforesaid, and amongst all and every the subjects of us, our heirs and successors, whatsoever and wheresoever, notwithstanding the not full and certain describing the nature or quality of the said invention, or of the materials thereto conducing and belonging. In witness whereof, We have caused these our letters to be made patent. Witness ourself at Westminster, the sixteenth day of March, in the seventeenth year of our reign.

By writ of privy seal,

C O C K S.

A

A DISCOURSE on the SCURVY.

THE scurvy is a name given to so many disorders of the body seemingly of a different kind, that it may justly be said to be a manifold and complicated disease. The chief symptoms of it however are clearly described by several authors, which are such as these: the gums rot first; then the skin is defaced with livid and black spots; ulcers ensue, especially in the swelled legs; and these are with difficulty, if ever, cured. In the last stage of the distemper, even the bones become carious.

It is therefore very plain, that this malady is a kind of corruption of the blood, and the whole mass of the bodily humours. This, when the cause is long continued, increases to a degree of putrefaction. All writers are agreed in their opinion, that it is a northern disease; imputing it to the cold and moist air of those climates, together with the use of stagnating and saltish waters, and the unwholesome food of hard, dried, and salted meats. They therefore observe, that it rages most, even to be in a manner universal, among the inhabitants of the Baltic sea, in Finland, Norway, Denmark, and the places adjacent to the Germanic ocean. And indeed not only the new Latin name, *scorbutus*, but our English one too, is plainly made from the Saxon *schorbock*, or *schorluck*, denoting a griping or tearing of the belly *.

This is the same distemper, which Pliny, from the ulcers in the mouth and legs, calls by the name of

* Vid. Eugalen. de scorbuto, & in primis Sennert. lib. iii. part. v.

stomacace,

Somatrace, or rather *Somocace*), and *sceletyrbe*; ascribing it to the drinking of bad waters; and for which, he says, the herba Britannica, which is our hydrolapathum, or water-dock, was found to be a remedy*.

But long before this, Hippocrates † himself took notice of this disease, as a distemper of the spleen, proceeding very much from cold, raw, and turbid waters.

Such is this distemper at land. At sea, in long voyages, it is much more violent; so far, that many are of opinion, that upon the two elements it is a malady of a different kind. But it plainly appears from comparing what has been said of that at land, with what I am going to mention of the same at sea, that the difference is only in the degree of malignity.

The history of the progress of this cruel enemy is so judiciously and exactly related in Lord Anson's voyage round the world ‡, when he came into the South sea, where his men were in a most terrible manner afflicted with it, that I cannot give a more lively description of it, than by taking out of this most entertaining and instructive book the most material circumstances which occurred in its several stages. This I am the better enabled to do, because being incited by the extraordinary events to make a full inquiry into this whole affair, I have not only had the honour of discoursing with his Lordship upon it, but have also been favoured with the original observations of his two ingenious and skilful surgeons ||, from which I

* Nat. histor. lib. xxv. § vi. † De internis affection. § xxxiv. & de aërib. aquis, & locis, § x.

‡ Pag. 100. &c.

|| Mr Ettrick and Mr Allen.

have leave to transcribe whatever I find to my purpose.

The first appearances are much the same in the two diseases at land and at sea; but at sea they soon run to a much higher degree. Nothing is more surprising than the malignity of this, as it were corrosive, poison exerting itself so far, that the scars of wounds, which had been many years healed, were often forced open again. Nay the callus of broken bones, which had been completely formed for a long time, was found dissolved, and the fracture seemed as if it had never been consolidated.

This malady was likewise accompanied with many other dangerous symptoms, particularly putrid fevers, pleurisies, the jaundice, an obstinate costiveness, and, at the latter end, a difficulty of breathing. This last was found to be the most deadly of them all: for it never was without such a faintness and weakness, that many expired upon the least motion, and endeavouring to get out of their hammocks, died before they could reach the deck.

Moreover, a strange dejection of the spirits, with shiverings, tremblings, and dreadful terrors on the slightest accidents, was so constant an attendant, that whatever discouraged the sick never failed to add new force to the distemper.

Such are the strokes of this compounded calamity: and many more might be enumerated: but it is time to proceed, and to inquire into the manner by which they are produced.

It is certain, that such bad diet as has been mentioned, will corrupt the blood and humours; but nothing is clearer from the whole history of this voyage, ~~than~~ this, that the air is, even more than any other agent,
concerned

concerned in bringing on the mischief *. It may indeed justly seem strange, that the writers of physic should not have observed so remarkable a cause; but they described the land-scurvy only. Nay, so great was the efficiency of the aërial fluid, that even a warmer climate did not mitigate the scorbutic virulency; neither did fresh provisions, and plenty of wholesome rain-water avail; although these are certainly of great importance in preserving the body from the fatal disorder. Of so much consequence it is to resist the first approaches of an enemy.

Now, the manner in which the aforesaid causes act, is this. Whoever understands the use of respiration, and the way by which the several offices necessary to life are performed by means of it, will readily comprehend how the sea-air acquires such noxious qualities.

To set this in a clear light, it must be observed, that air entering into the lungs does by its gravity and elasticity press upon the blood circulating in the vessels there. The effect of this pressure is twofold; first, a comminution and division of it into smaller particles; secondly, some subtile elastic matter passes into the blood, and exciting in it an intestine motion, disposes and prepares it for the secretions of several liquors, when, in its course round the body, it arrives at the glands contrived for the separation of such and such juices.

Whatever therefore alters this gravity and elasticity, makes the air unfit for the purposes for which it was designed. In the first place, moisture weakens its spring; next, a combination of foul particles, such as are contained in the breath of many persons croud-

* See voyage, p. 294.

ed together, and some perhaps diseased ; then, the filthiness of water stagnating in the bottom of the ship ; lastly, salts imbibed from the sea, some of which may probably have proceeded from putrefied animals in that element, may insinuate themselves into the blood, and, in the nature of a ferment, corrupt its whole mass. Neither is it amiss to add, that the animal spirits themselves must necessarily partake of the vitious disorder of the fluid, from which they are derived. This is plain from that unaccountable faintness, and weakness of the body, and dejections of mind, which, as we have before taken notice, accompany the other symptoms.

It is needless to shew how all the enumerated complaints, and indeed many more, may follow upon such a disturbed state of things, especially when the other mentioned causes concur. It may be very satisfactory to put down the observations, which the above-named surgeons made upon the blood of their patients, and upon the dissection of dead bodies, in the several stages of the distemper.

In the beginning, as it flowed out of the orifice of the wound, it might be seen to run in different shades of light and dark streaks. When the malady was increased, it ran thin, and seemingly very black, and after standing some time in the porringer, turned thick, of a dark muddy colour, the surface, in many places, of a greenish hue, without any regular separation of its parts. In the third degree of the disease, it came out as black as ink, and though kept stirring in the vessel many hours, its fibrous parts had only the appearance of a quantity of wool or hair floating in a muddy substance.

In

In dissected bodies, the blood in the veins was so entirely broken, that by cutting any considerable branch, you might empty the part, to which it belonged, of its black and yellow liquor. When found extravasated, it was of the same kind. And lastly, as all other kinds of hæmorrhages are frequent at the latter end of the calamity, the fluid had the same appearance, as to colour and consistence, whether it was discharged from the mouth, nose, stomach, intestines, or any other part.

The effects we mentioned of the violence of the scorbutic humour being so malignant as to open the scars of old wounds, and dissolve the calli of fractured bones, which had for a long time been formed, appear to many to be quite incredible; the rather, because, as they commonly say, a bone thus reunited is stronger in that part than in any other of the same joint. This indeed, I dare venture to affirm, is not true in fact. The case is thus: A callus is no more than a kind of cementation made by filling up the space between the broken ends of the bone, with the nutritious juice from the part. This, when nicely examined, is found to be more porous, and to have less solidity, though the bone often appears bigger than the part above and below it; the fibres are smaller, shorter, and not so regularly disposed as in the natural texture. In short, a callus is an imperfect ossification. For this reason, when the nutritious particles themselves have acquired a corrosive acrimony, they may, like a menstruum, work upon and break the texture of this superadded cement. Which is indeed a most surprising phenomenon.

It is proper after all to observe, as a confirmation

of this reasoning, that although the callus is dissolved by the disease, yet, upon the patient's recovery, it is gradually formed again, in proportion to his coming to a right habit of body. I have before me a remarkable instance of this kind. A sailor had one of his clavicles fractured in December, which was immediately reduced, and soon united. The dressings were taken off in January, and he made use of his arm as before. In the following April, as he was suspending his body by the arms, the same clavicle was disunited, and the callus gave way as at first. He at that time complained of some symptoms of the scurvy; which daily increased till June following. At that time he was carried ashore at the island of Juan Fernandez. The bandages being removed, the fracture appeared in the same condition as when the accident first happened, without the least remains of a callus: notwithstanding the proper applications, he could not use his arm until the middle of October; the callus having continued more than three months in a flexible state. From that time, by the use of a vegetable diet, and living on shore, he gradually recovered from the distemper; the callus was confirmed, and his usual strength returned.

But it is time to come to the cure; which will be, first to prevent the attacks; and in the next place, to remove the effects of this virulent evil.

The first care to be taken is of the diet. And here I must take the liberty to make some observations upon the manner of victualling our ships. The trials already made, as I have been informed, of Mr Lowndes's salt made from brine, prove it to be much preferable, for salting provisions, both flesh and fish,

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to that made from sea-water, even to the bay-salt. Some experiments of its use I have made myself; and our college, being consulted by the Lords of the Admiralty, gave their opinion in its favour. There is in this nothing of that noxious quality, whatever it be, which is always found in the marine salt, and cannot, by any known methods, be separated from it; and which, as we see, makes the sea-air, as well as its water, unwholesome. And I cannot but say, that I am sorry to see some of our physicians, of late years, so fond of prescribing the drinking of it to their patients, particularly in scrophulous distempers. I am well assured, that it has sometimes brought on scorbutic symptoms, besides other mischiefs.

I must add, that if, instead of our salt-fish, stock-fish, which is dried without any salt, were provided, it would be more wholesome. The Dutch do so; and also, in lieu of oatmeal, they put on board gort, which is, as I have been informed, a kind of barley ground; and is not so hot and drying as oatmeal.

I will here relate what that experienced and brave admiral, Sir Charles Wager, once told me in a discourse I had with him concerning the health of our seamen. He said, that one year, when he commanded our fleet in the Baltic, his sailors were terribly afflicted with the scurvy: but he observed that the Dutch ships, then in company with ours, were much more free from this disease. He could impute this to nothing but their different food, which was stock-fish and gort; whereas ours was salt-fish and oatmeal. He was then come last from the Mediterranean, and had, at Leghorn, taken in a great quantity of lemons and oranges. Recollecting, from what he had often
heard,

heard, how effectual these fruits were in the cure of this distemper, he ordered a chest of each to be brought upon deck, and opened every day. The men, besides eating what they would, mixed the juice in their beer. It was also their constant diversion to pelt one another with the rinds; so that the deck was always strewed and wet with the fragrant liquor. The happy effect was, that he brought his sailors home in good health.

It is very commonly known, that, in our East-India ships returning home, the men are very much affected this way, and that upon their very approach to the island of St Helena, they are strangely relieved by the fresh odoriferous air; and perfectly recovered, after some days, by eating the fruits we have mentioned, and living chiefly upon the vegetables, which kind nature has supplied that place with in profuse plenty.

What has been said may serve for a very good proof of the reasonableness of the advice given some years ago, by our college, to the Lords of the Admiralty, viz. that a quantity of wine-vinegar should be allowed to the company of every ship. This qualifies the salt of the food, and makes some amends for the want of sub-acid fruits. But I must remark, that the vinegar of strong beer has neither the flavour nor the virtue of that from wine; and ought indeed to be forbidden our tables.

I shall conclude what I have to say with regard to feeding on herbs, in the scurvy, with a remarkable relation, contained in a book published, not many years since, by a Dutch physician, on this subject*.

* *Observationes circa scorbutum, auctore Johanne Fred. Bachstrom. Lugduni Batavor. 1734. 12mo. p. 8.*

A sailor, in one of the Greenland ships, was so entirely broken and disabled by this disease, that his companions, when the fishing was over, put him into a boat, and sent him ashore; leaving him there to perish, without the least expectation of a recovery. The poor wretch had quite lost the use of his limbs; he could only crawl about upon the ground: this he found covered with a plant, which, having nothing else to support life, he, continually grazing like a beast of the field, plucked up with his teeth. Every country is, by the bounty of Providence, provided with antidotes against the diseases to which its inhabitants are chiefly liable. In a short time, he was by this means perfectly recovered to his strength, and, after his return home, related the fact to this writer. It was soon after observed, that this herb was *cochlearia*, or scurvy-grass. Some of it was, for inquiry's sake, brought over hither in pots, and was found to be somewhat different from that of our country, being more mild, and not so pungent and sharp.

Thus much for the vegetable diet. I must add, that besides the herbs and fruits mentioned, there are many others very wholesome in this disease: some like *cochlearia*, of a subtile and volatile juice, as the *nasturtium*, *beccabunga*, or brooklime; others more cooling, and therefore more proper in hot constitutions, or feverish heats, as sorrel, endive, lettuce, purslain, &c. And, indeed, I think it will be best to join in use the hotter with the colder, that they may qualify each other; especially, because the acid fruits were found, in Lord Anson's voyage, to be of most extraordinary benefit*.

* See voyage, p. 117. and also 308.

Neither ought it to be omitted, that milk of all kinds, when it can be had, and its whey, which may be clarified with some of the herbs now named, is an antiscorbutic food and physic.

But, as the design of this discourse is to demonstrate the usefulness of the preceding machine, it will be right to add some illustrations and observations to those I formerly made in my paper read before the Royal Society, and reprinted in Mr Sutton's book *.

I have already taken notice, that the reason why the writers upon this disease have not ascribed it more to the air, than they have done, must be, because they were more acquainted with it at land than at sea. Now, it is very plain, that as the hurtful qualities of the sea-air must be heightened by its being closely confined, without due circulation, particularly when it is also saturated with effluvia from the breath of many persons almost stifled up together; so the continual shifting and changing of this element, must of course be attended with great advantages; nay such perhaps, as one unacquainted with the nature of things, would hardly be brought to believe. But I refer to my mentioned paper, and Mr Sutton's additions.

I must lastly remark; that it is almost incredible how soon the sick, even though just dying, begin, when brought ashore, to feel the salutary effects of the land: for whereas the Commodore had buried twenty-one men in two days, before his arrival at the island of Tinian, yet he did not lose above ten, during his two months stay there †. For so healing, and contrary to the malignity and bad qualities of the sea-

* Above, p. 220. † See voyage, p. 307.

air, was that of the land, that the patients, even upon their being exposed upon the ground, immediately recovered.

But it may seem still more marvellous, that the vapour of the cold earth itself should also contribute to their speedy recovery. Lord Anson told me, that one of his men, who rowed the boat ashore, was so weak, that he fell down at the oar almost dead : when landed, the poor man desired his mates that they would cut a piece of turf out of the soft ground, and put his mouth to the hole : upon doing this, he came to himself, and grew afterwards quite well. This puts me in mind of what I have formerly seen done by the boys on Shrove-Tuesday, the too cruel anniversary martyrdom of cocks ; when one of these creatures was knocked down and expiring, it was sometimes brought to life again, by instantly putting his head, for a short time, into a fresh-made hole in the earth.

This sudden good effect of fresh air affords a plain proof of what we have before said, that, besides the blood, the animal spirits themselves are very much affected in this disease : for such immediate relief could only be given by the means of this active fluid, the main instrument of all vital motions. And as the protracting this advantage in the open air is the cure at hand ; so the making a constant circulation even of that which is not so wholesome, in the ship, must do a great deal towards the prevention of the distemper.]

R. M.

The End of the SECOND VOLUME.

